EDUCATIONAL METALCRAFT

Presented to H.M.C.I. A. E. Scougal, LL.D

The "Scougal" Casket.

DESIGNED AND EXECUTED BY P. W. AND W. A. DAVIDSON.

THE Casket is supported by three sloping legs, reminiscent of those huge cranes that are common objects in the shipyards of the Clyde. Surmounting the Casket proper is the figure of St. Mungo, the Patron Saint of Glasgow. On one side of the Casket is a Limoges Enamel Panel of the Cathedral, on the other side the University is similarly treated, while the third carries the inscription below which are the Arms of Mr. and Mrs. Scougal, executed in Limoges Enamel.

LONGMANS' TECHNICAL HANDICRAFT SERIES

EDUCATIONAL METALCRAFT

A PRACTICAL TREATISE ON
REPOUSSÉ, FINE CHASING, SILVERSMITHING
JEWELLERY, AND ENAMELLING

SPECIALLY ADAPTED TO MEET THE REQUIREMENTS OF THE INSTRUCTOR, THE STUDENT, THE CRAFTSMAN AND THE APPRENTICE

BY P. WYLIE DAVIDSON (D.A., GLAS.).

INSTRUCTOR, THE GLASGOW SCHOOL OF ART
INSTRUCTOR, THE SUMMER SCHOOL, ST ANDREWS

WITH A FOREWORD BY
FRA. H. NEWBERY

DIRECTOR (EMERITUS), THE GLASGOW SCHOOL OF ART

WITH 378 ILLUSTRATIONS

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AUTHOR'S NOTE

In presenting this work on Educational Metalcraft my thanks are specially due to Fra. H. Newbery, Mem. Int. Soc. S.P.G., A.R.C.A., Director Glasgow School of Art, for much valuable assistance; also to Mrs. Fra. H. Newbery, Mrs. Herbert MacNair, Miss Jessie M. King, and Miss Ann Macbeth, for the liberty to reproduce several of their designs; and to Miss Phœbe M. Brooke, M.A., for literary help.

F. Wylie Davidson.

FOREWORD

By FRA. H. NEWBERY

The revival of the Decorative Arts in Great Britain, now some forty years since, was brought about, not by any movement on the part of the various trades concerned in production, but was due rather to the action of a body of artists, who, while fully recognizing the excellence of the tradition of workmanship that existed, resolved, or rather endeavoured, to re-infuse into the trades, a new conception of the possibilities of Art as applied to material. Their task was a difficult one. Manufacturers were fairly content with the financial returns that were coming in: any decoration that was employed appeared to satisfy the taste of the customers, and it was considered that innovations were likely to upset the existing order of things.

And, whether the product of the workshops was manual or mechanical, the same unwillingness to make changes was shown. The only alternative was to attack the buying public and cause them to be dissatisfied with the artistic character of the goods they were receiving. This was accordingly proceeded with.

Two factors, for the purpose, came into existence. The one was the artist craftsman, of the type of William Morris, who produced what he thought the public should have in the matter of Decorative Art, and who trusted to the creation of a sufficient number of customers to enable him to carry on his venture; and the second was the organization of a national system of Art education for the craftsman and art worker. And much as this latter has been despised and made light of, there is little doubt that the enormous change that has taken place in the attitude of the public towards Decorative Art, is due in no small measure to the quiet and persistent influence of the education given in the Art Schools of the Kingdom; an influence that, however ill-exerted at the commencement, owes much of the success that has now come to it, to the fact that the artist craftsman, who had broken with the trades, gave the educational system his fullest support, because he saw in it that raw material of workmanship, which, infused with Art, would produce the

worker and helper that he desired. These two factors are still in existence.

The artist craftsman has been joined by the artist craftswoman, and these two have proved such strong competitors to the trade houses for the custom of the public, that the manufacturer has been compelled, oftentimes in spite of himself, to cater for the new conditions of demand: a demand that has been brought about by giving to the artisan and to the general public alike, an education in Art and some instruction in the possibilities of design as applied to material.

Many weaknesses have attended both the work of the artist craftsman and the instruction given in the Art School, but the most noticeable has been that lack of workshop knowledge and tradition, that is prone to attach itself to the labours of the artist craftsman, working independently of trade requirements and catering simply for his or her own circle of customers.

Only quite recently has it been possible to say that the technique of such a worker approached the ordinary standard of workshop requirement, and in the technical studios of the various Schools of Art, though much has been made of designs on paper and of the theory of Art as applied to material, little insistence has been made upon practice and upon the need for an excellence of workmanship to make such application acceptable. This deficiency is being supplied by calling in the skilled artist craftsman to teach to the students of our Schools of Art, that technique and workmanship which, coupled with appropriate design and treatment, complement each other in the production of the perfect work of Art.

One of such craftsmen is the author of this book. Mr. Davidson is possessed of a long and varied experience in the many branches of the metal-worker's art, and is filled with the traditions of the workshop, and he has endeavoured to put into words the theory and practice of those trade methods and processes of which he is a proficient and versatile exponent and instructor. Mr. Davidson can speak with an authority given to very few, and although in Art instruction the tongue is a poor substitute for the hand, the pictures with which the book is furnished may serve to make speech the vehicle for action.

FRA. H. NEWBERY,
Director (Emeritus)

THE GLASGOW SCHOOL OF ART,
August, 1913.

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EDUCATIONAL METALCRAFT

CHAPTER I

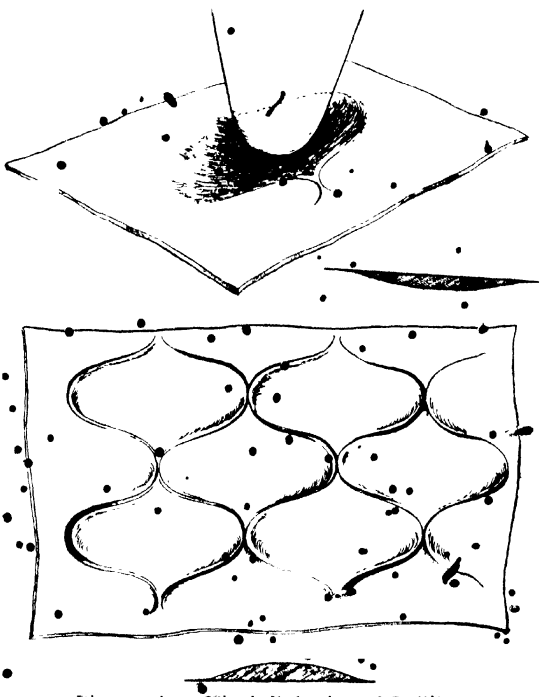
METAL REPOUSSÉ AND FINE CHASING

Metal Repoussé is the term applied to a style of decoration used in artistic metal-work, consisting of the appropriate treatment of sheet-metal to produce a design in relief by the embossing of certain areas; this effect being heightened by the aid of incised outlines on the surface of the metal itself (Diag. 1 and 1A).

This modelled effect is obtained by the application of hammer and punch, with the metal resting on a bed of pitch, or similar substance; the design is then either beaten down, or bossed up from the obverse side.

In most of the modern work, the term "repoussé" is given in a general way to various types of metal-work, whether hand-wrought or stamped.

Fine Chasing consists of the enrichment



Diag. 1 and 1A.—Simple Embossing and Outlining.

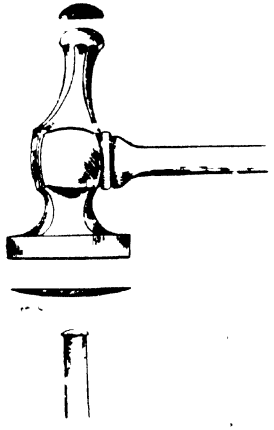
of a previously embossed surface by touches applied with sharp tracers, planishers, and punch marks. This style of decoration is confined almost exclusively to gold and silver work, but the retouching of castings may be correctly included under this heading (Diag. 2).

Diag. 2.—Fine Chasing. The "Newbery Medal."

Necessary Tools.—The following list and description of the tools and material employed in simple repoussé, and the means of acquiring their correct application, are arranged mainly to suit the requirements of the young student. Although few in number, the punches in size and shape should be as perfect as possible.

This is important from an educational point of view, as, to a certain extent, the more limited the number of tools the greater is the scope for individual ingenuity, and the more complete will become the knowledge of technique.

The Hammer.—A tool probably made in the first place to produce an instrument and action similar to that of the human arm with clenched fist. The original form soon gave rise, however, to many variations in shape to suit different needs. The hammer used in repoussé and fine chasing (Diag. 3) is formed on light and smart lines, being intended mainly for rapid and spirited manipulation; its usual weight is about 3½ to 4 ounces.



Diag 3.—The Chaser's Hammer.

Many workers favour hammers of varying weights, but as the completed work is mainly the outcome of the craftsman's skill, irrespective of tools, it will be quite possible to adapt one hammer to various types of work.

The general length of the hammer shaft is 8 inches; the best material lancewood, owing to its suppleness; it must have a slender, curved, tapering shaft to ensure a perfect "spring," and be equally balanced, and provided with an oval end to afford a grip which accommodates itself to the form of the hand.

The shape of the hammer head varies, each face having its special application. The larger, being round but flat, may, if secured in the bench vice, be used as a small anvil, or adapted as a planishing hammer;

the small or "bullet" face will lend itself readily to tapping up small details in repoussé, or bruises in hollow vessels; upon occasion, too, it can be utilised as a riveting hammer.

How to hold the Hammer (Diag. 4).—Grip the thick part of the shaft in the palm of the hand, closing the fingers round it, with the exception of the forefinger, which latterly is placed upon the top of the tapering part of the shaft, pointing towards the hammer head, the thumb in position as shown in the illustration. Hold the elbow well up, almost on a level with the shoulder, and apply the hammer in a succession of light, sharp blows; this action produces a uniform vibration and causes the punch to travel freely when guided over the metal surface.

Diag. 4.—The holding of the Hammer.

The Punches are generally made either of square steel rod or from cylindrical lengths of wire, filed or forged to the desired shape and size.

Excellent results, however, are obtained by the use of tools made from thick brass wire, or from large iron nails, carefully smoothed off at the head with a file. The tracers are exclusively used for indenting, or incising the outlines of a design on the metal surface, and must be made of steel so tempered towards the face that they are unaffected by contact with the metal.

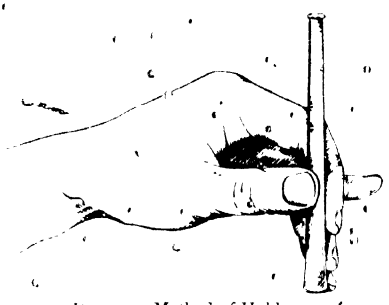
Large blunt tools, oval or round in shape and intended mainly for embossing or modelling, will work more effectively if not tempered; their comparative softness, and hence freedom from excessive vibration, proves most useful for raising purposes.

Avoid having the punches more than 4 inches long. The larger tools, such as the planishers, embossers, and modellers, should be a shade shorter.

Remember, the shorter the tool, the less the vibration and the easier the manipulation.

How to hold the Punch.—Guide the punch with the thumb and first three fingers of the left hand, with the small finger pointing as illustrated (Diag. 5). Always keep the third finger on the metal surface, *guiding* the punch, *not drawing* it, but permitting the vibration of the hammer blows to set the tool travelling. It is important for the student to master these points, as a bad style can never produce good work.

Additional tools for the execution of exclusive and finer work are dealt with in Chapter VIII.



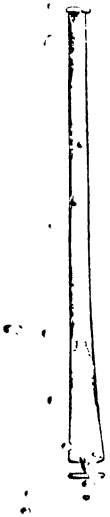
Diag. 5.—Method of Holding.

REPOUSSÉ PUNCHES

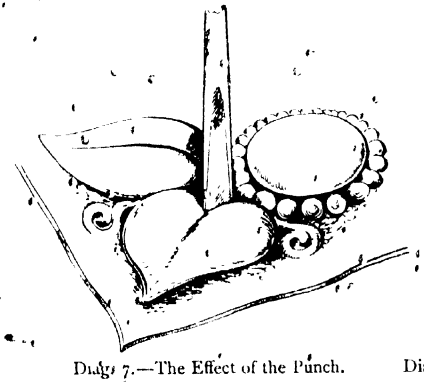
1. Large Straight Tracer or Outliner.
2. Small Straight Tracer or Outliner.
3. Pear-shaped Grounder.
4. Square-faced Back-grounder.
5. Large Oval Flat-faced Planisher.
6. Large Oval Rounded Modeller.
7. Medium-sized Dot.
8. Several Wooden Punches.

THEIR USES.

The Large Straight Tracer (Diag. 6) has a blunt and well-rounded face, which is a necessity for the acquirement of a soft effect throughout



Diag. 6.—The Punch.



Diag. 7.—The Effect of the Punch.

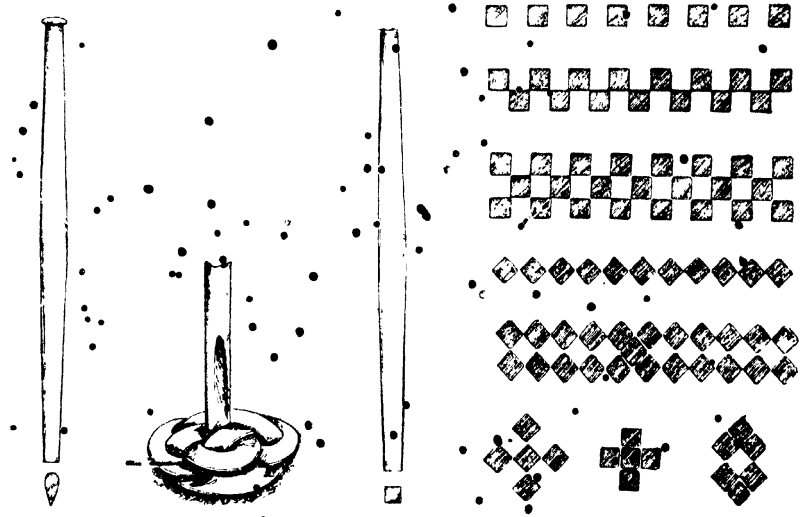
Diag. 8.—The Small Tracer.

the work. The sharp or ragged line resulting from the cut of a tool with square or imperfectly smoothed edges should be avoided. The

large tracer is used for incising continuous straight lines or large sweeping curves (Diag. 7).

The Small Straight Tracer (Diag. 8) will be found in size and form suitable for the execution of fine lines, sharp curves, or intricate detail. Half-round tracers are purposely omitted from this assortment of tools. They are unnecessary in repoussé, and are used mainly on fine chasing.

The Pear-shaped Grounder is chiefly used in the setting down of "grounds," and specially for those parts where acute angles or tapering sections predominate (Diag. 9).



Diag. 9.—The Punch. Diag. 10.—Its Effect. Diag. 11.—The Punch. Diag. 12.—Effect of its Application.

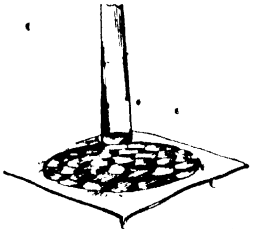
It is also of service in laying down the sharp-cut edges on a design, and in softening bands, ribbons, and interlacing strap work (Diag. 10).

Its full value can only be ascertained by actual experience and constant practice.

With its convenient and long tapering shape it may well be considered an indispensable implement.

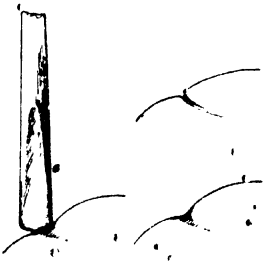
The Square-faced Back-grounder (Diag. 11) has, as its name implies, a square face with softened edges, and is most effective in laying down those right-angled sections of a ground which may exist in a decoration (Diag. 12).

Diag. 13.—The Punch.



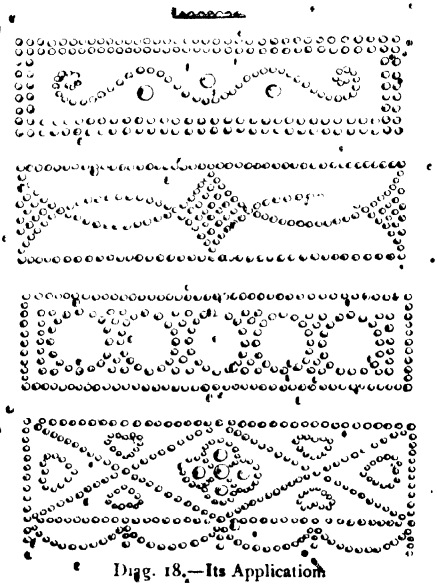
Diag. 14.—Its Result.

Diag. 15.—The Punch.



Diag. 16.—Its Application.

Diag. 17.—The Punch

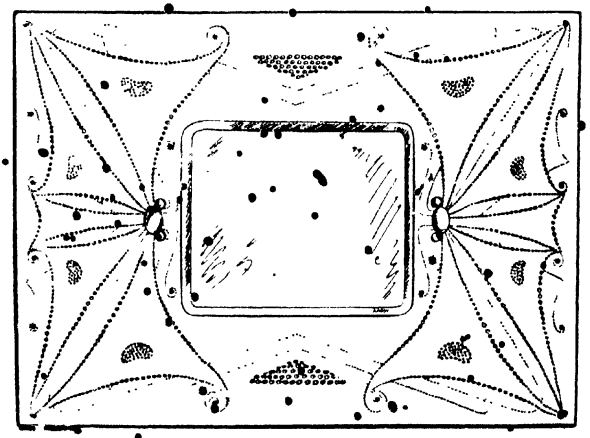


Diag. 18.—Its Application

A beautiful texture can be obtained by its agency, a pattern of chequered squares being the result.

The Large Oval Flat-faced Planisher (Diag. 13) is of great service in setting down large masses on surface, or throughout the background of the work. Rapid hammering must accompany its use, with a slow and uniform travelling of the punch. The result will be an effective planished surface (Diag. 14).

The Large Rounded Modeller (Diag. 15) is mainly employed where full or embossed parts occur in a design. It is wrought from the obverse side with the pitch slightly warm. The oval form and soft edges of this tool will suggest innumerable decorative forms in simple repoussé, all



Diag. 19.—Mirror in Stitched Decoration.

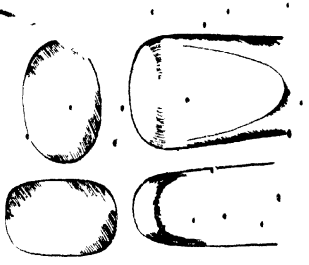
the exclusive result of this punch in the creation of pattern and design (Diag. 16).

The Lead Block (Diag. 77) will also serve as a convenient base for the manipulation of this punch, especially where small details occur.

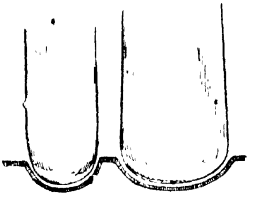
The Medium-sized Dot (Diag. 17).—This punch, skilfully applied, is productive of simple but unique effects on the metal. Diag. 18 will convey an idea of the effects got either by incising with the punch on the front of the metal, or working it from the obverse side—the sunk tool impressions, or the spirited raised dots proving equally effective. The "stitched" mirror (Diag. 19) is entirely the result of this tool used in three sizes.

Some Wooden Punches will complete the set of tools. They can be made from any odd lengths of fairly hard wood: they are round, oval, or square in section, and should have softened edges (Diag. 20).

These tools are indispensable for successfully raising large masses in relief. Their size should be that of the average "easel pin." As in the case of the steel or brass modeller, the pitch must be slightly warm when



Diag 20.—The Punches.



Diag 21.—The Application.

applying the wooden punches, thus materially assisting the "drawing up" of the metal (Diag. 21).

Important Rules.—Never use a small tool where a *large punch will do the work.*

Avoid the use of a steel tool where a wood or horn mallet can be substituted; the effect of the softer tool is preferable, and its use is less liable to crack or harden the metal.

CHAPTER II

METALS, THEIR CHARACTERISTICS: METAL GAUGES

Suitable Metals.—The following lists include the commoner of those baser metals best adapted for decorative metal-work. They are all admirable mediums in which to realise the craftsman's skill.

Copper	Brass	German Silver
Tin	Lead	Pewter
Aluminium	Duralumin	Bull Metal
Steel (mild)	Zinc	Bronze

Copper is in many ways the most valuable, and its extreme ductility and general adaptability render it indispensable to the young student. From an artistic point of view, it is a singularly beautiful metal, readily reflecting tool impressions, and producing enhanced colour effects if subjected to suitable chemical agents. To the enameller it is a perfect medium, and conduces to the finest results in this branch of the craft. As with silver, so with copper, a sudden lowering of temperature ("quenching," *i.e.* plunging the hot metal into cold liquid) will not result in cracking through unequal expansion, but will tend to soften or anneal the metal.

Brass, with its rich yellow shades of colour, ranks almost equal in importance to copper, and provides a valuable medium for the craftsman. In brass, however, a brittleness entirely absent from the copper is always inherent, which renders work with it much more difficult. The treacherous nature of the metal gives rise to cracking at the most unexpected moments. Caution must be exercised in the execution of the work, and it must be frequently and carefully annealed while under the hammer or punch.

Certain alloys are softer, but all retain a natural brittleness. In ordinary commercial decoration, and particularly in work of an ecclesiastical character, brass is almost exclusively employed.

When working brass or its equivalent alloys, it is most important that sharp-faced tools be avoided, preference being given to those possessing smooth and softened edges. The observance of this rule will greatly simplify the difficulties arising from the nature of this medium.

German Silver and similar alloys can be wrought with highly satisfactory results. The feature of this metal is its beautiful grey tone, and silvery finish; it will also wear white throughout. Like brass, it may exhibit a tendency to crack, thus necessitating care in working.

Tin can be effectively wrought, its unique colour schemes giving excellent decorative results; but owing to its excessive softness these effects are not easily obtained, unless at the hands of an experienced craftsman.

Lead, in thin sheet to minimise weight and possessing a clean and level surface, lends itself to many distinctive styles of work, especially when employed in the execution of mirrors, fireplaces, draught-screens, etc. For exterior decoration it offers great possibilities, being practically unaffected by deleterious atmospheric conditions.

Pewter, a pleasing and ductile medium possessing tones of lovely grey, has many applications. Friezes, door-panels, dados, and other interior decoration can be made from this metal. It is advisable that this work be undertaken by a competent craftsman; modern treatments are not, as a rule, very satisfactory. Old pewter work, with its silvery tone and graceful shapes, is practically a lost art.

Aluminium is a beautiful and effective medium for repoussé decoration. It admits of varied schemes when used in the execution of commercial signs, lamps, electro fittings, and cabinet furnishings. Owing to its extreme lightness and adaptability it is indispensable in the theatre property room. It may be worked successfully on pitch (if well greased) or on wood.

Duralumin is an alloy of aluminium with the strength and hardness of mild steel.

It may be wrought in a manner similar to copper, brass, or German silver, and provides a perfect substitute for steel, when lightness combined with the strength of that metal is required. Duralumin is rust-proof.

Bull Metal is similar to copper in nature and colour. It responds readily to the blow of a hammer, and may be cast; in sheet it retains enamel.

Steel (Mild) does not find the same favour with modern craftsmen as it did with workers in past centuries; artificers whose chief joy was

expressed in the engraving, chasing, and embellishment of armour, shields, and similar requirements of the Age of Chivalry. It still offers many inducements, and lends itself to combinations with gold, silver, and enamel. Sheet steel in various sizes and of good surface may be readily obtained; its mild condition permits of easy working, and it will readily respond to the punch when resting on a pitch surface.

Zinc is capable of many interesting effects; but as this metal has fixed limitations, it is entirely unsuitable for elaborate tooling. In working its surface in repoussé avoid continuous incised outlines, and rely mainly on a soft modelled effect produced by application of the tools over the obverse side of the metal; all incised lines should soften and die away at intervals. The tone of zinc is inclined to be heavy and dead, but the parts in relief may be given a silver-like polish.

Bronze is admirably adapted for casting purposes. Being durable and rich in colour, it possesses innumerable possibilities decoratively. Light dies may be cast in this medium, and serve excellently for striking small details in gold and silver.

The Precious Metals.—Gold and silver are the "precious metals" on which the finest technique of the gold and silver-smithing craft is expended. The scope for intricate design and execution embraces all that is delicate and perfect in the art. Needless to add, proficiency in these higher exercises of the craft can be achieved only by years of diligent practice.

Gold, of a characteristic yellow colour, is termed the "noble" metal. It is softer than silver but harder than pure tin, and proves the most valuable agent in the execution of the finer branches of the craft.

Silver is one of the most beautiful and workable of the metals. It is of pure white colour capable of a high polish; this finish, unfortunately, in these times of mechanical aid, is largely overdone. The ideal surface is the proverbial "silver grey." For fine chasing, engraving, silver-smithing, and enamelling, the precious metals provide a perfect medium.

Metal Gauges for the Baser Metals.—It is important that the student acquire an intelligent knowledge of the different thicknesses of metals necessary for the varying types of work, combined with the particulars of their relative strength, and possibilities of design.

The Birmingham Wire Gauge (B.W.G.) is the generally recognised standard in use for the baser metals. The sizes are graded with numbered slots; the smaller holes being those with the higher numbers. For example, sizes 16 to 18 correspond to the thickness of an average penny. For ordinary work in repoussé sizes 20 to 25, B.W.G., will be

found quite suitable. Sizes 20 and 21 are reserved for larger and heavier work.

If beating on wood, or similar mediums, sizes 21, 22, 23, and 24 will prove the correct sizes. A convenient substitute for the gauge plate may be found in tab samples of the respective sizes of metal, cut with the shears, and numbered. These should be linked on a metal ring, and hung in a suitable place for reference.

Memorial tablets, shields (if large), panels, plaques, or similar objects demanding a specially flat surface must be wrought in sizes 19, 20, or 21 according to their general dimensions.

It should be remembered, if a large plate of metal be beaten and completed without annealing, it will obviously be much tighter and harder through the omission of that process; when therefore using sizes 24 or 25 on wood, retain the metal in the above condition.

The Birmingham Metal Gauge (B.M.G.) being slightly at variance with the gauge plate used for the baser metals, will be liable to prove misleading to the beginner. For example, sizes 8 or 9 B.M.G. in gold and silver have their equivalent in sizes 22 and 23 B.W.G. brass or copper. Great care, therefore, must be exercised when ordering metal. Experience will in time provide the necessary knowledge of the different gauge plates.

In purchasing the baser metals it will be more advisable and economical to order it by the sheet, size 4 feet by 2 feet, or in continuous rolls 1 foot in diameter.

The precious metals may be ordered by the ounce, or cut to a specific size.

CHAPTER III

MEDIUMS—PITCH, WOOD, LEAD, WAX, AND CLAY

Pitch as a suitable base for the metal during the execution of repoussé occupies the first place; all the strongest effects and finest details being obtainable by the use of this medium. Gold and silver vessels previous to being chased are also filled with this material as a support.

Qualities.—Pitch is prepared in two grades, "hard" and "soft." The harder medium is exclusively used for working with the precious metals, and where fine details predominate; its firm surface affords the necessary resistance to the sharper punches, and more delicate tooling. The softer kind is used where large, bold work demands a responsive and yielding bed.

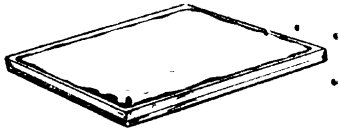
Preparation.—In the mixing of the pitch the first consideration should be its quality, whether "hard" or "soft." The crude material can be purchased from a drysalter, the price being about 2*d.* per lb. Melt the substance in a three-legged pot, over an open fire or gas ring. A flat-bottomed pot should be avoided owing to the danger of bursting. Having reduced 9 or 10 lbs. of pitch to a watery condition, gradually mix in plaster-of-Paris, fine whiting, or brick dust, stirring the mixture thoroughly till it assumes a thick consistency. Finally one or two small cakes of tallow should be melted into the mixture (cheap tallow candles will do). If a specially hard medium is required, add half a cup of powdered resin. With the various ingredients well wrought together, drop a test-piece of the pitch on a flat iron or stone, gauging its resistance by pressing the face of a punch into its surface when cold. If it yield too readily, add more resin and plaster-of-Paris; if it be too hard, more tallow. Newly prepared pitch does not work so freely as the medium that has been already used.

Table of Ingredients—(with approximate proportions).

Pitch (crude), Swedish	8 to 10 parts
Resin (powdered)	1 part
Plaster-of-Paris, whiting, or brick dust (all perfectly dry)	7 parts
Tallow	1½ to 2 cakes

NOTE.—The plaster-of-Paris, etc., hardens, whereas the tallow softens the pitch. Pitch during the winter will require more tallow to counteract the hardening effects of the weather.

Pitch Box.—This utensil is of the greatest value (Diag. 22). It may be made of wood or metal. Wood, for general purposes, is preferable, and as a non-conductor is more easily handled when filled with hot pitch The pitch box should be from 12 to 15 inches square, and about ½ an inch in depth. When made it is filled with the prepared medium, either mixed as directed above, or purchased (made up) from 9*d.* to 1*s.* per lb.; a box complete costing from 2*s.* to 5*s.* according to its dimensions.



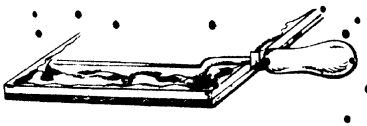
Diag. 22.—The Pitch Box

In choosing a pitch-box, insist on having the pitch flush with the top of its sides; this permits of great freedom in the manipulation of the punches, as compared to the annoyance caused by a ditch or rim of wood projecting above the level of the pitch surface.

Metal Trays of thin sheet iron may also be used. Their advantage consists in better withstanding the application of heat: also if required they may be emptied and refilled with a hard or soft grade of pitch.

Diag. 23.—The Pitch Bowl and Triangle.

Chaser's Iron Bullet or Pitch Bowl is mainly employed in the execution of fine chasing, or in the engraving of the cells in Champlevé enamel. Its natural half-ball shape and pronounced weight, combined with the wooden triangular rest or leather collar, render it specially adaptable for this work (Diag. 23). Its surface may be softened over a gas jet or by the aid of a hot metal spatula (Diag. 24).



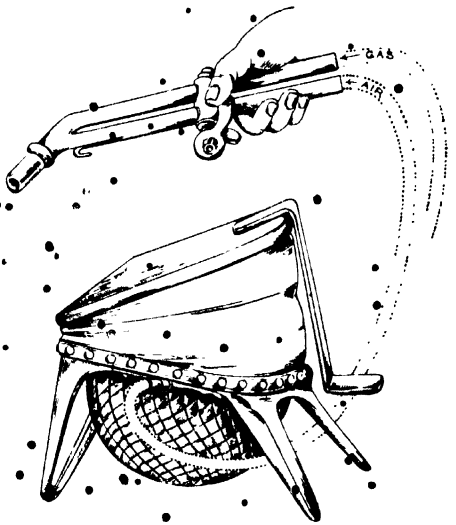
Diag. 24.—The Spatula.

The Metal Spatula, as illustrated, is a most useful implement in shaping

the bed of pitch to any desired form. It may be heated in an ordinary fire, or over a gas ring. The student can easily forge the tool from an iron bar, bend it at one end to a suitable angle for working, and fix it into a wooden handle.

Application of Heat to the Pitch Surface.—This process demands special care in the concentration of the flame to avoid "scorching" the medium, which would cause it to lose its adhesive property.

The gas blow-pipe and foot-blower (Diag. 25) is most suitable for this work, or, as a substitute, the warm glow from an open fire. If this latter method be employed, spread a paper beneath the box, as a safeguard against the pitch dripping.



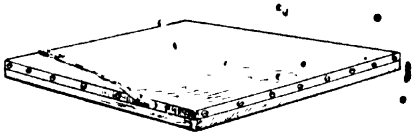
Diag. 25.—The Blow-pipe.

The difficulty of manipulating the pitch box, especially in homework, frequently gives trouble to the beginner, but a little practice will soon overcome the difficulty. In applying the blow-pipe over the pitch surface avoid excessive air blast, thus minimising the danger of burning the surface.

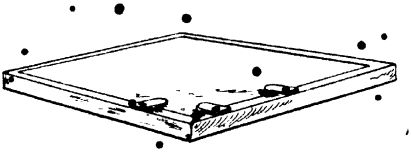
Soft Wood is a valuable substitute for the pitch bed, provided the size of metal does not exceed 22 B.W.G., but quite a good result may be obtained with this size. The wood block should be in proportion to the dimensions of the metal, but preferably it should never be less than 2 inches in thickness. This will ensure a solid base for the repoussé. The surface may be considerably improved by the addition of thick brown paper, or felt, inserted in layers between the metal and the wood.

Fixing the Metal to the wood block will be best accomplished by the use of screw nails, which will not spring during the hammering process (Diag. 26). Small, revolving metal snibs will be found of equal service (Diag. 27). The objectionable part of repoussé on wood is the noise created by the hammering; this may be greatly deadened by working over a rubber-mat, sand-bag, or cushion.

Sheet Lead for certain types of work will provide a suitable base. A harder metal must be screwed over the face of thin sheet lead. After completing the work, and releasing the metal from the lead, a beautiful soft impression will be reflected on the soft lead as a result of



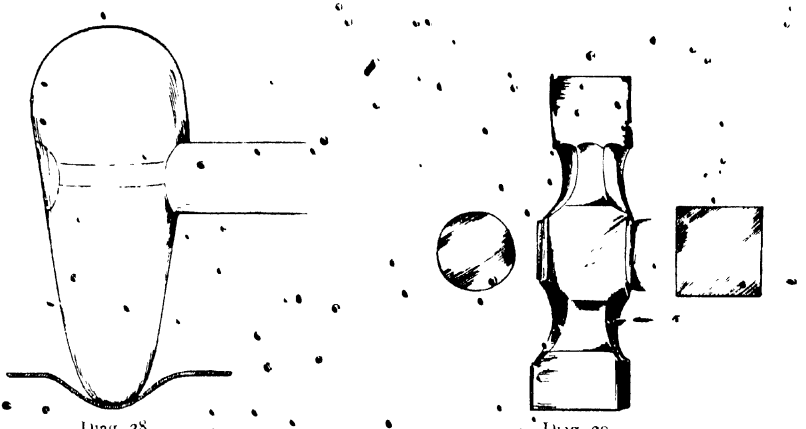
Diag 26.—Fixing with Screws.



Diag. 27.—Fixing with Snibs

the tooling. By the above method only can the best results be obtained in repousse on lead.

Wax or Clay may be utilised where large, smooth areas of metal are to be embossed, their pliability rendering them fully responsive to the blow of a doming mallet (Diags. 28 and 29) or round-faced steel hammer.



Diag 28. Diag. 29

Wooden Mallet and Steel Planishing Hammer.

The cleanliness of the wax or clay allows the progress of the embossing to be easily followed; simply lift the metal to examine the effect of the tooling, and replace without heating or cleaning.

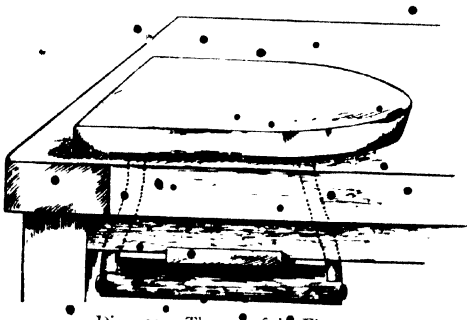
Large Vessels with repoussé ornamentation may be partly filled with dry sand, plaster-of-Paris, or whiting to minimise the quantity of pitch.

CHAPTER IV

PRELIMINARY PREPARATION OF THE METAL

To the student in the early stages of this craft, the process of planishing the metal to a uniform surface is most important; it is necessary owing to the unavoidable twisting and puckering, incurred when cutting the metal to size with the shears or chisel. The defect must be remedied before the design is transferred, or a punch is applied to the surface of the metal.

The Planishing.—Commence this process by resting the metal on a smooth steel surface (the bench anvil), or an excellent substitute will be found in an ordinary flat-iron secured in the bench as illustrated (Diag. 30).



Diag. 30.—The use of the Flat-iron.

Avoid planishing on wood, as irritating bruises will be produced, usually not discovered until much harm is done. Grasping the metal firmly with the left hand, and using only the *flat-faced wooden mallet*, beat solidly, with the blows all falling on one spot of the anvil, at the puckered edge of the sheet, at the same time revolving the metal so as to expose all irregularities to the mallet. A study of the arm action will ensure the correct application of the mallet in this process. Uniform weight in the blows is obtained by retaining the upper arm close to the side, and partly resting upon the body, thus permitting full play to the wrist. If the face of sheet metal present convex bruises, a few well-directed blows will remedy the defect.

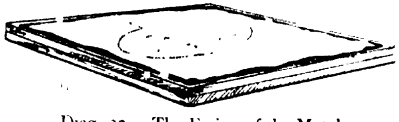
In the choice of a surface, keep the smoother and convex side to the top, as the subsequent work on the metal will tend to draw it level. During the process of planishing, it is important to preserve the face of the mallet and the metal free from grit; neglect of this precaution will result in undesirable blemishes occurring on its surface, and, in the case of gold and silver, will prove most injurious to their purity. Some preliminary training with the wooden mallet will serve to make the manipulation of the steel planishing hammer (Diag. 29) more easily mastered.

Fixing the Metal on the Pitch. The process of securing sheet metal to the surface of pitch requires a certain preparation and practice. The corners of the sheet, and a few places along the edges, must be slightly turned down by means of the pliers as shown in Diag. 31.

Diag. 31.—Bending the Metal Edges with the Pliers

These projections supply a grip to the metal, when pressed into the previously softened pitch, thereby minimising all risk of the work springing, or developing a "bossness." Before bedding the metal on the pitch, it is always advisable to grease the obverse side with tallow or vaseline. A brush and small cake of tallow should be kept at hand for this purpose.

The advantages of the tallow are twofold; first, it ensures a cleaner surface of metal when it is removed from the pitch, and secondly, the adherent tallow has the beneficial effect of increasing the ductility of the pitch. Never, on any account, allow the metal *to be damp* previous to fixing it on the pitch surface, as the presence of water is almost certain to interfere with its solidity. Secure the metal by firmly pressing it into the warm pitch, taking the precaution of laying it *slowly* to permit all accumulated air to escape; otherwise it will be liable to collect in bells, and cause an unsatisfactory surface.



Diag. 32.—The Fixing of the Metal.

The above pressure will cause the soft medium to ooze a little over the metal edges. Having slightly greased the fingers, or dipped them in plaster-of-Paris, proceed to draw a narrow overlapping margin of pitch over the edges of the metal, thus preventing it from springing (Diag. 32).

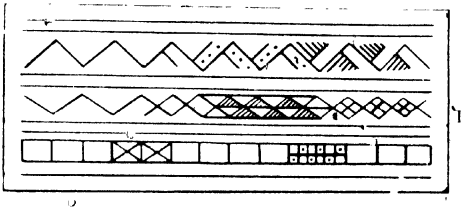
Removal of the Metal from the Pitch Box.—If the work be perfectly cold, the metal will be easily released from the pitch surface by inserting at its edges a fairly large chisel, and carefully chipping it off. However, if the metal surface be slightly warm, the light application of the gas blow-pipe or open fire will be preferable. Remember, a liberal application of tallow is always a reliable agent when separating the metal from a pitch surface.

CHAPTER V

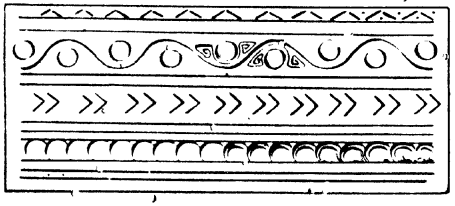
ELEMENTARY EXERCISES IN THE PRODUCTION OF PATTERN AND DESIGN BY THE USE OF TOOLS AND MATERIAL ONLY

The illustrated exercises in this chapter are prepared mainly to meet the requirements of the beginner.

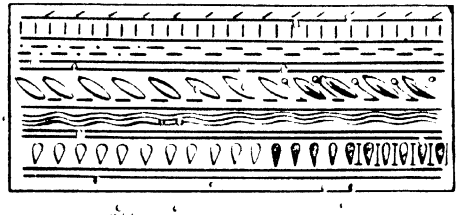
Diags. 33, 34, and 35 present a grouping of various lines, producing pattern and design, and resulting exclusively from the application of the large and small straight tracers, combined with the pear-shaped back-grounder, the smaller tracer being used for the curves and other irregular lines.



Diag. 33.



Diag. 34.



Diag. 35.

Three Pattern Plates.

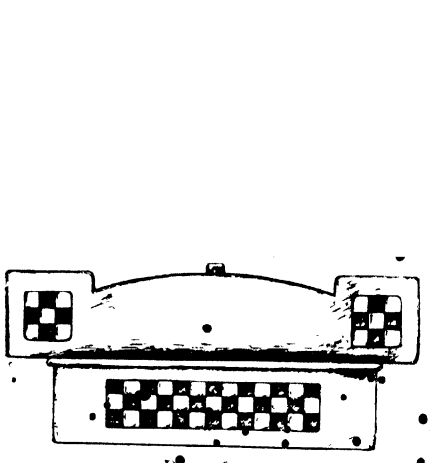
Diags. 36 and 37 represent the adaptation of the previously executed outlines in the decoration of a simple wall bracket and photo-frame.

Rich effects are obtained by the use of the dotting punch only (Diag. 38), or in conjunction with the outliner.

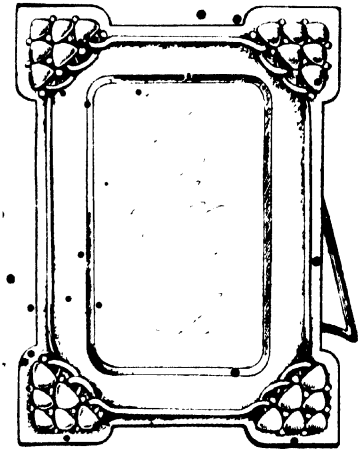
The dot may be made in several sizes, as required, to produce exclusive results.

Diags. 39A, 39B, 39C, and 39D will convey different arrangements of these simple forms in repoussé on various objects; while Diag. 40 introduces the use of the larger punches, combined with the dot (sharp and blunt)

and tracer. The student will profit largely by a continuation of the above exercises, until an intelligent knowledge is acquired of the

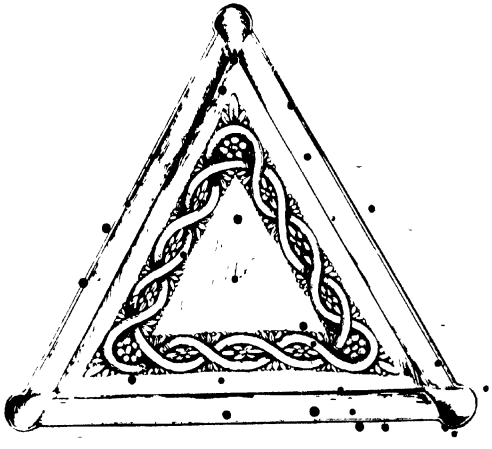


Diag. 36.



Diag. 37.

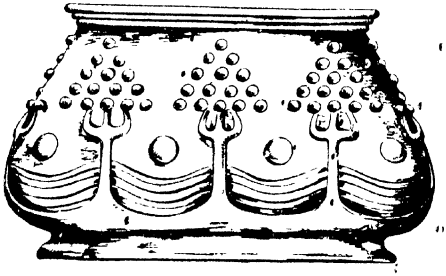
Wall Bracket and Photo Frame.



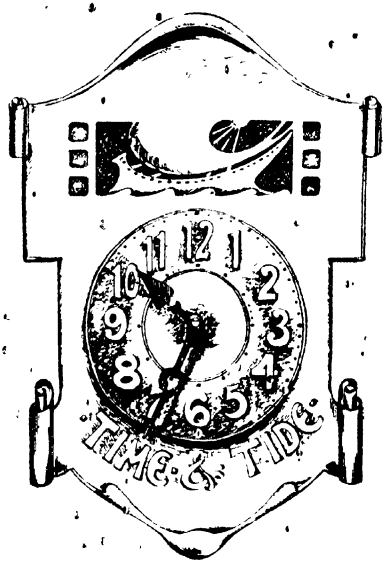
Diag. 38.—Card Tray.

innumerable patterns to be obtained from the *exclusive use of tools and material.*

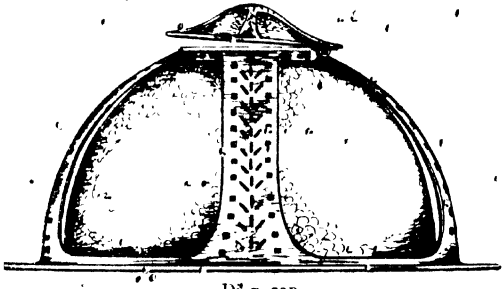
The **Transferring of a Design** to a metallic surface may be accomplished in several ways; **carbon paper** being the principal medium for all general



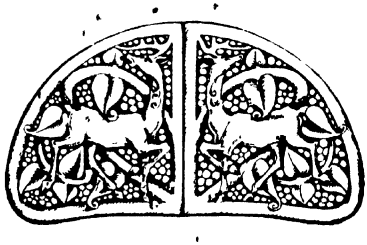
Diag. 39A.



Diag. 39C.



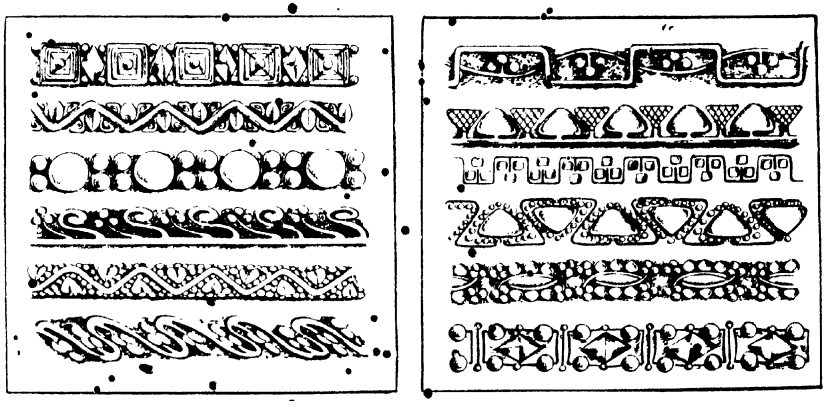
Diag. 39B.



Diag. 39D.

work. The susceptibility of the metal will be vastly improved if a thin wash of turpentine or gamboge be applied to its surface previous to the placing of the carbon paper. In transferring and laying on the design

a greater degree of accuracy and success will result if a centre line be first drawn (in pencil) down the metal, this line serving as a guide in securing its correct position. In transferring a design, carefully place the outline in position, likewise ease up the top half (Diag. 41), and



Diag. 40.

slip in the carbon paper. If the work is large, secure the position of the design by placing a lead block or flat-iron on its surface until the transference of the design is complete. After obtaining a clean

Diag. 41.—Application of the Carbon Paper

Diag. 42.—The Draw-point.

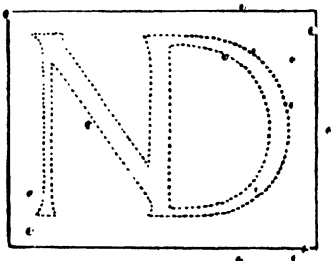
impression, the outlines may be fixed on the metal by tracing over their surface with a steel draw-point or hard pencil (Diag. 42).

White Beeswax is the best medium for the transferring of small and intricate detail, and is of special service in gold and silver work. The wax is transmitted to the metal by lightly rubbing a thin film of

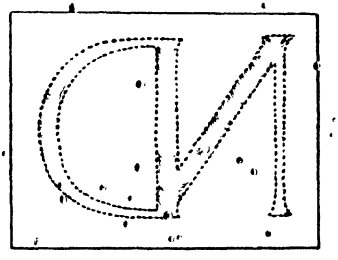
the medium over the previously heated metal. When thoroughly cold, place the drawing or tracing in position with the pencilled side towards the wax surface; now rub freely over it with a burnisher, which will transfer the outline of the design to the susceptible wax ground.

Soap may also be used for transferring a design. It must be employed only in a damp condition, and merely sufficient to provide a thin, dull film over the metal. A clear impression will result by resting the outline on the above surface, and subjecting it to the pressure of the pencil. This medium is mainly adapted for large openwork.

Stitching the design to the metal is much in vogue among professionals. It consists in fixing the paper design to the metal by sealing



Diag. 43A. Stitching the Design.



Diag. 43B.—Obverse side.

it at various points with a spot of melted pitch: the outlines are then lightly pricked through with a fine dotting punch, and reproduced on the metal by a series of incised dots. If the work be large, the design may be transferred with pencil, and afterwards fixed to the metal with stitches, applied at intervals with the corner of a small tracer or blunt dot (Diags. 43A and 43B). This impression is reproduced on the obverse side (Diag. 43B), and may be used as a suitable guide when embossing the work.

After stitching an outline, if difficulty is experienced in following the dots, a slight rub in circles with fine emery cloth will clearly emphasise them. The stitching may be attained with the metal resting on a flat surface of wood, or over a block of lead.

CHAPTER VI

EMBOSSING AND SURFACE TOOLING IN REPOUSSÉ

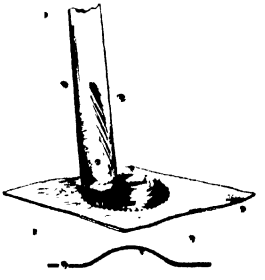
THE "**Embossing**" of a metal surface must be accomplished in the most direct and simple manner: avoid overworking, otherwise the medium will become unduly stretched, and liable to crack or prove weak in parts. After outlining, and previous to embossing, have the metal well annealed. If embossing on a bed of pitch, keep its surface sufficiently warm to admit of the metal "drawing" freely.

Wooden Punches, and the **Doming Mallet** (Diag. 44) will prove the most useful tools in working large surfaces or bold relief.

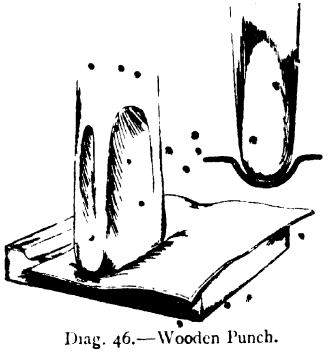
In their application, always hammer rapidly, and guide the punch slowly: only by this method can the texture of the tool on the metal be fully realised.

Diags. 45, 46, and 47 will convey various effects in relief resulting

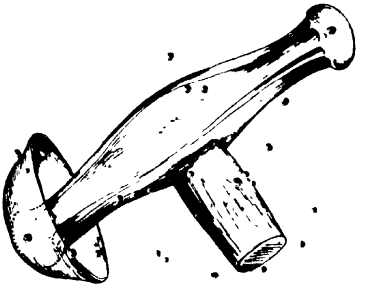
Diag. 44.—The Doming Mallet.



Diag. 45.—Steel Punch.



Diag. 46.—Wooden Punch.

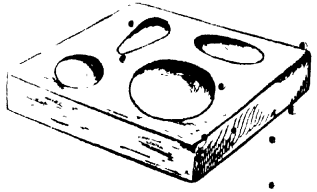


Diag. 47.—Ball-faced Hammer.

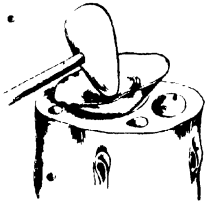
from the use of the steel and wooden punches, also from the ball-faced hammer.

The Wooden Doming Block (Diag. 48) can easily be acquired by each student, and suitable depressions and varying shapes sunk with a carving tool on its surface. An old bench or tree block (Diag. 49) may be adapted in a similar manner. All the above tools will prove of special assistance when embossing the metal.

Small Punches are to be avoided when raising parts in relief, as they



Diag. 48.—The Wooden Doming Block.

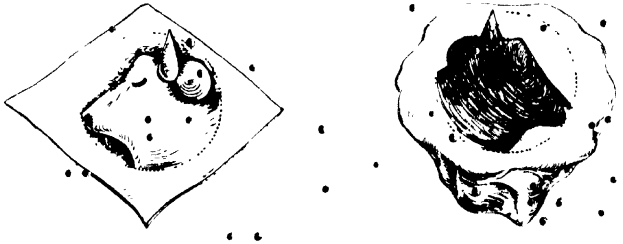


Diag. 49.—The Tree Block.

have a tendency to give a hard and overwrought effect to the work, besides hardening and finally cracking the metal.

Sharp outlines and small tools are necessary when the design embodies fine lines or keen edges. The pitch for this work must be almost cold, and the metal solidly fixed to its surface, for the obvious reason that the parts wrought where resistance of the pitch is greatest will produce a clearer and sharper result.

Chaser's Wax, or Modelling Clay[1] will give a fair idea of the relative



Diag. 50. Squeeze in Wax.

heights obtained after embossing, if a "squeeze" be taken of the metal surface (Diag. 50).

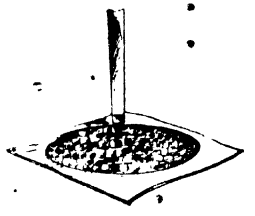
[1] NOTE.—Recipe given for its preparation in Chapter XX.

The Modelling and Surface Tooling will now follow the embossing of the metal. After cleaning the metal (see Chapter VII.) give the obverse side a moderate application of tallow or vaseline; then rest it face downwards on a convenient clean surface, and fill the cavities with melted pitch (Diag. 51). When cold it may be fixed on the pitch box. This method will ensure perfect solidity, which is necessary to a successful result. If the work is large, the modelling and tooling may be proceeded with while the pitch is slightly warm. Aim at the greatest possible effect, with the minimum of tool application.

Diag. 51.—Filling the Embossed Parts with Pitch.

Backgrounds will be set with the large flat modeller, square, or pear-shaped grounders, manipulating them with an irregular action (Diags. 52 and 14). Avoid grounds with a uniform pattern, as they invariably prove conflicting with the other parts of a decoration.

Remove the Work from the Pitch with a fairly large chisel, but only if the metal is perfectly cold, and previously well greased. Annealing, where unnecessary, is better dispensed with, as the metal always seems to lose a certain original beauty of tooling by passing through the fire.



Diag. 52.—Background.

Repoussé on Wood will provide better results in relief if the tracers are applied at an angle sloping outward from the work. By skilful working of the tools, and careful setting of the background, exceptional height and effect is obtainable by the above method. If the metal appear weak, a light backing of plaster-of-Paris, or the fusing in of a little soft solder, will materially strengthen the higher parts.

Embossing on Lead, to ensure good results, must either be wrought exclusively with ivory, bone, or hard wood tools, or have a sheet of brass or copper secured over the lead surface, and the tooling wrought only on the harder medium. This process results in a delightful, soft impression of the tooling being indented on the lead.

Sheet Lead will cut easily if a sharply pointed knife is drawn down its surface, and a small slit is then cut with the shears previous to tearing it down the line.

CHAPTER VII

ANNEALING, PICKLING, AND CLEANING OF THE METAL

Annealing is the softening of a sheet of metal, and is usually attained by the application of heat.

The gas blow-pipe, with foot-bellows, will for all general purposes prove most adaptable; a forge, or small blast fire, may also be used, while even an ordinary house fire will be of service.

Heat Concentration must be distributed over the metal in uniform waves, avoiding overheating in parts, and aiming at a dull "cherry red" colour.

Hold the blow-pipe with one hand only, controlling the air and gas-valves with the forefinger and thumb, in conjunction with a light application of the foot-blower.

Direct the flame in a regular wave, not in spasmodic jerks.

Pitch is cleaned off the metal by maintaining the flame over its surface until only a white ash remains.

Brass, German Silver, and Similar Alloys are safer if *gradually* heated up, and allowed to cool *slowly*. Sudden "quenching" may result in the metal cracking.

Silver and Copper, immediately after annealing, may be plunged into a cold liquid without the risk of cracking.

Gold of 15 carat and under will be safer if permitted to cool before "quenching."

Wires during the annealing process should be coiled in circles (Diag. 53), thereby minimising the danger of burning them, and economising the gas.

The Mouth Blow-pipe (Diag. 54) must be used when annealing fine wires; rest them on a charcoal block, or pad of asbestos.

Zinc, Pewter, and Aluminium, if showing signs of brittleness, may be softened if immersed in boiling water.

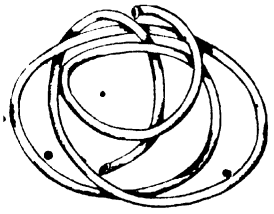
Chemical Cleaning by the use of a "pickle" will now follow the annealing.

The following ingredients and proportions will provide a serviceable pickle :—

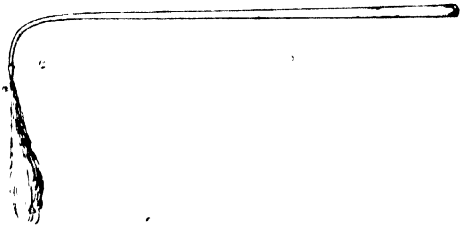
Sulphuric Pickle.—One part sulphuric acid, or oil of vitriol, and 7 or 8 parts of water.

NOTE.—Add the acid to the water.

In practice these quantities are subject to variation according to the work in progress; a stronger solution is obtained with an increased



Diag. 53.—Wires ready for Annealing.



Diag. 54.—The Mouth Blow-pipe.

quantity of acid. Other pickles will be dealt with as the work proceeds; however, for all general purposes the above will prove satisfactory.

A Vat, or Large Jelly Jar will be a suitable vessel for containing the pickle which, if kept free from dust, will retain its strength for a considerable time.

After Annealing, permit the metal to cool before pickling, which will ensure the complete removal of all residue. If allowed to remain immersed for a few minutes, the process will prove more effective. Small objects will be more completely cleansed if the "pickle" is brought to boiling point, using for this purpose a copper boiling pan (see Chapter XI., where illustrations and directions for its construction are given). After use, keep the pan immersed in water to counteract the action of the acid. Avoid the use of iron in removing work from the pickle, as the contact will result in a film of iron oxide discolouring the metal; this condition is particularly objectionable when working with gold and silver. To clean filigree several methods may be employed. Annealing and boiling off in pickle is the most direct, but has the disadvantage of unduly softening the fine wire. Alcohol mixed with silver whiting to the consistency of a paste, applied with the finger, then brushed and finally washed off, will be preferable.

Scouring the metal surface will follow the annealing and pickling.

Use for this work fine sand, or ground bath-brick, applied with a small scrubbing brush in a damp condition. Gold and silver work will require powdered pumice. Apply all these substances with a circular action: this method will ensure a uniform tone, as compared with the scratched or uneven finish resulting from a back-and-forward action.

After scouring, wash off in water, afterwards drying the metal thoroughly, to avoid the rusting of steel tools during future operations. **Jewellery**, or work of similar nature, may be dried in a tin box filled with boxwood sawdust, and heated over a gas-ring.

Pitch may also be removed from the metal surface by the application of tallow, oil, or turpentine. The latter ingredient is mainly of service in the cleaning of small objects, or intricate detail. In this process the article may be immersed or washed over with the spirit, and finally rinsed off in boiling water. Great precaution must be exercised in the use of the turpentine, owing to its inflammable nature.

In using the tallow, or oil, have the metal fairly warm to melt the pitch, applying at the same time, a handful of coarse sawdust over its surface; with the application of a brush the pitch will disappear, and a uniform clean surface remain.

Candle wax, pitch, or similar objectionable matter, may be cleaned off candlesticks, sconces, or work with fine detail (without annealing) with a slight application of naphtha. Spirits of turpentine will also provide a good cleansing agent, but special care must be exercised in the use of either medium.

In removing pitch from a deep hollow vessel, apply the heat to the top edge first, thus affording a free air escape, and preventing the danger of an explosion.

Small work may be effectively dried in a tin box, or chamber, filled with boxwood sawdust and bran, slightly heated.

Large work may be dried with the blow-pipe flame (if unfinished).

Polished or finished work may be dried by immersion in boiling water, and wiping with a soft cloth.

CHAPTER VIII

SIMPLE TOOLS AND HOW TO MAKE THEM

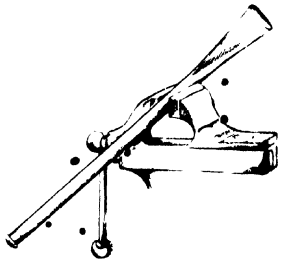
HAVING attained a certain proficiency in the application of the common repoussé punches, it will be essential to direct the student in the production of additional tools suitable for more advanced work.

The Necessary Materials are a good bench-vice (Diag. 55), or strong hand-vice as a substitute; one large (flat) rough file; one medium-sized, half-round, rough file; one medium-sized, half-round, smooth file; all varying in length from 9 to 10 inches.

A small grindstone will render good service in smoothing up, also an oilstone, and several sheets of emery cloth.

The steel may be obtained in square rods, or in wire of different thicknesses and selling at about 1s. per lb.

This quantity will provide sufficient material for the production of thirty or forty punches.



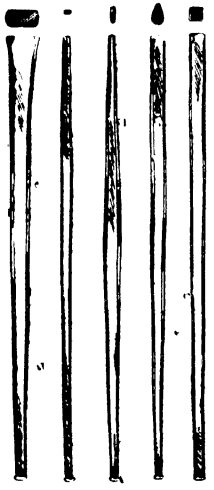
Diag. 55.—Bench-vice with Steel Rod in Position.

Brindles or Blanks (Diag. 56) of forged steel may be purchased ready for "facing" at so much per dozen from any of the Jewellers' Supply Warehouses. (See Chapter XXXIII., Trade Addresses.)

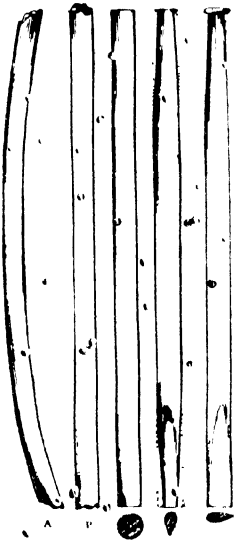
Prepare the Steel by cutting it with the edge of a half-round file, while secured in the vice, to lengths of 3½ and 4 inches (Diag. 57, A). The heavier punches are more easily worked if short, owing to their greater solidity. After cutting, they must be straightened upon a steel stake or flat-iron with a fairly heavy steel hammer (Diag. 57, B). Several of the lengths may be made red-hot and forged to suit various shapes and sizes of the tools (Diag. 58).

Large Iron Nails, or Thick Brass Wire may easily be transformed into oval embossers (Diag. 59, A and B).

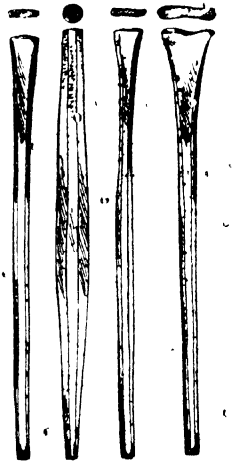
Diag. 60 will convey an assortment of the most useful additional tools



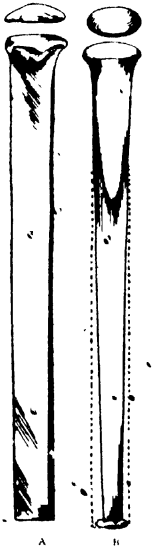
Diag. 56.—Brindles.



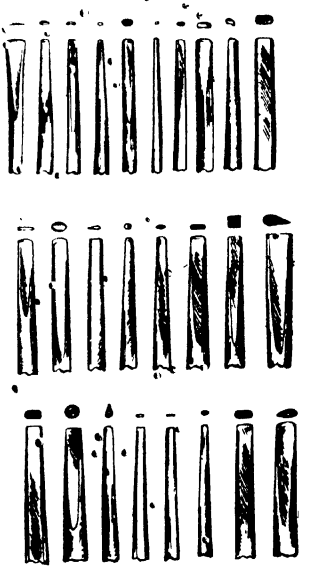
Diag. 57.—A, Wire; B, Straightened.



Diag. 58.—Forgings.



Diag. 59, A and B.—Punches from Nails.



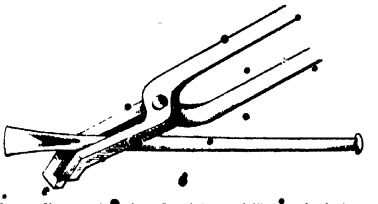
Diag. 60.—Assortment of the best Punches for Repoussé and Chasing.

required in the execution of repoussé and fine chasing, all being quite within the scope of the student desirous of adding to his stock.

Gravers and Turning Tools will be better made from square steel rod, its shape, combined with a superior quality of the material, proving more adaptable.

Tempering is accomplished by first protecting the face of the tool with a blob of soap (Diag. 61); this precaution prevents scaling of the metal, and likewise ensures greater success in tempering. Apply the heat with the blow-pipe, or insert the tool in an open fire, until a bright red diffuses the point; now "quench" in tallow or water (preferably tallow). After "quenching," test the point of the punch with a file; if in correct condition a moderate resistance only will be felt; if too hard, the file will instantly "skid" off the face of the tool. This condition will necessitate "drawing back," that is, the application of a limited heat, using the red-hot jaws of the tongs for this purpose. Retain them slightly above the tempered part of the punch (Diag. 62) until a pale straw colour diffuses towards the face of the tool; instantly quench, afterwards polishing with emery cloth, and finally "facing" up on the oilstone.

Diag. 61.—Protection of the Tool Face with Soap.

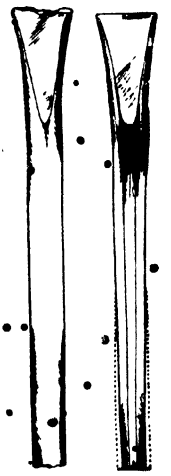


Diag. 62.—Showing Position of Tongs in bringing back the Temper.

In the use of the stone, a few drops of glycerine in conjunction with the oil will prevent clogging.

A Stone Slip, or Water-of-Ayr Pencil will prove effective in reaching small intricate sections of the tool face.

Several Cutting Chisels of various sizes will always be of service. A large chisel, suitable for dividing thick metal sheet, wires, etc., may be forged from thick steel, as illustrated (Diag. 63 A and B).

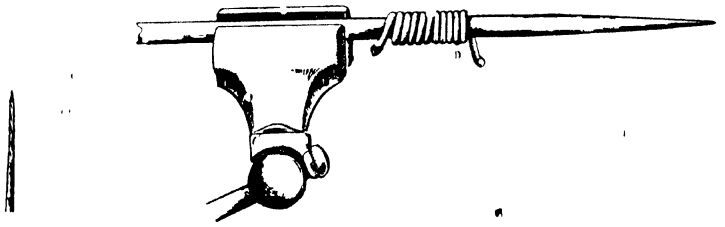


Diag. 63 A and B.—Large Cutting Chisel.

Chisels of a finer degree will be required in the piercing of chasings, together with the use of the fretsaw,

while their application in cutting the cells in Champlevé enamel is invaluable. In the finer chisels aim at a keen cutting edge, combined with adequate strength, and make the section of the face similar to Diag. 64.

The Steel Draw-point (Diag. 42) is an indispensable tool, its uses being manifold: viz. the scratching in of the transferred pencil outline;



Diag. 64.—Fine Cutting Chisel.

Diag. 65.—The Point adapted in the production of Rings.

stitching and piercing of holes; used as a centre punch; or employed as a mandril in the making of small rings (Diag. 65).

It can be easily made by the average student from a 6-inch length of round steel wire, or a small spindle, by simply filing one end to a smart taper, then smoothing with emery, and sharpening on the oilstone, afterwards tempering, as already described.

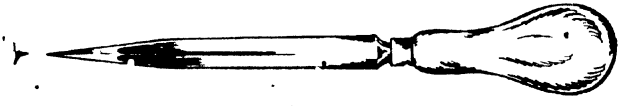
The Steel Burnisher (Diag. 66) may be made from ¼-inch steel wire, slightly forged and curved, as illustrated.

It will prove an effective tool in smoothing surfaces in intricate

Diag. 66.—The Steel Burnisher.

parts of the work; also in the preparing of panels in Limoges enamel, or in the setting of stones.

The Three-cornered Scraper (Diag. 67) may be made by sharpening



Diag. 67.

the edges of a three-cornered file, or from a ¼-inch steel rod. It will

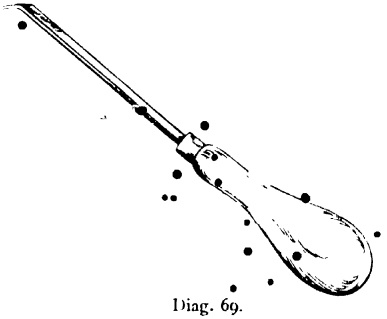
be useful in paring the edges of settings, previous to the application of the burnisher.

The Round and Flat Scraper (Diag. 68).—These tools will be found of great service in all repairing work; use the flat face for large surfaces, and the round face for hollow parts.

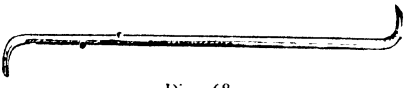
Both tools may easily be made by the student, and may be wrought from one piece of steel, as illustrated.

The Side Scraper (Diag. 69).—This tool is most adaptable in erasing scratches or similar blemishes on intricate parts of the work.

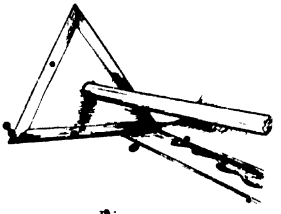
The Shave-hook (Diag. 70).—In scraping off surplus soft solder this tool is indispensable, and may be made in flat and half-round form.



Diag. 69.



Diag. 68.



Diag. 70.

It is easily produced from a medium gauge of sheet steel, riveting it to a tapering socket of steel wire for insertion in a wooden handle.

Several Snarling Irons (Diag. 71) of varying size can be forged from lengths of ½-inch steel.

Old poker heads may be adapted with little difficulty in providing many useful stakes (Diags. 72A, 72B, and 72C).

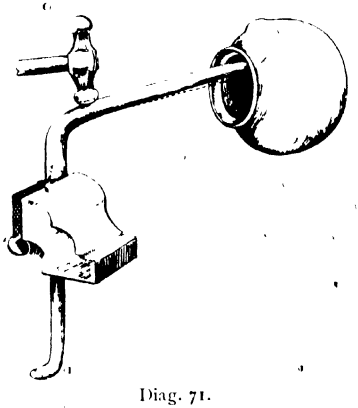
The soft round and oval forms can be effectively applied in sinking bowls of spoons, small salt cellars, or forms of a like nature.

The Reamer (Diag. 73) is a sharp, tapering point of steel, similar to the draw-point, but of triangular section, with keen edges as at A; it is useful for cleaning or widening circular holes during the process of riveting. The end of a file can be adapted for the above purpose, if well sharpened.

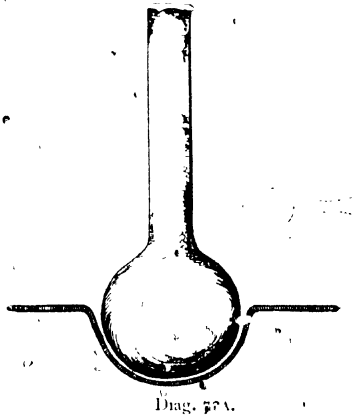
The Soldering Wig (Diag. 109) may be easily made from disused iron binding wire.

After the completion of a soldering, retain the wire until sufficient has been collected to weave into a loose cushion. This netting will prove of value in fixing different types of work during the soldering process.

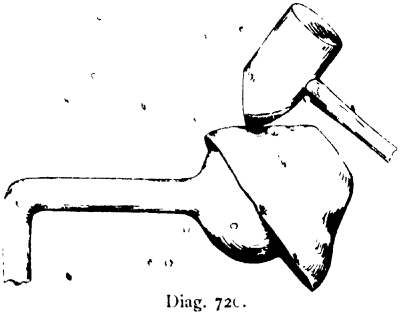
The Glass Surface Plate may be utilised as a convenient substitute



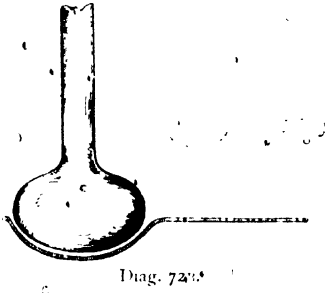
Diag. 71.



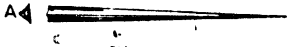
Diag. 72A.



Diag. 72C.



Diag. 72B.



Diag. 73.

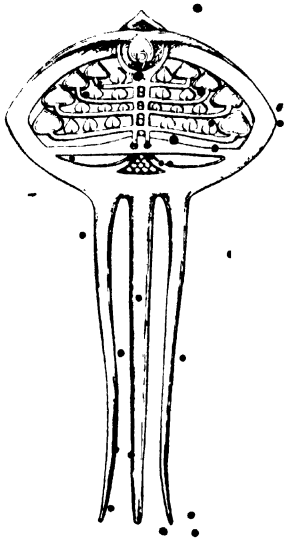
for the more expensive steel plate. It is simply a piece of plate glass, 6 or 8 inches square, and, being perfectly level, provides a satisfactory surface for testing the uniformity of hollow vessels.

CHAPTER IX

PIERCING THE METAL WITH THE SAW, DRILL, AND CUTTING CHISEL

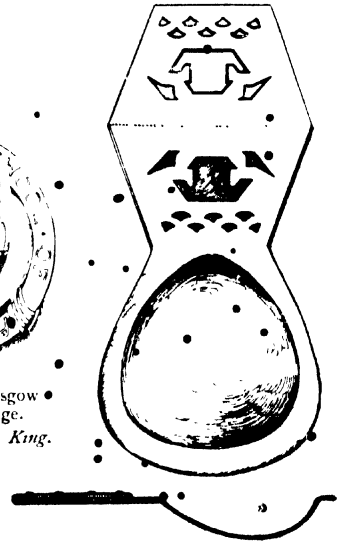
Saw Piercing in metal applied separately, or combined with repoussé, fine chasing, engraving, or enamelling, is productive of many varied and effective results.

Diag. 74 is an example of piercing, chasing, and engraving. While Diag. 75 will convey a treatment of enamel and piercing.



Diag. 75.—Piercing and Enamelling.

Diag. 74.—The Glasgow School of Art Badge. *Designed by Jessie M. King.*



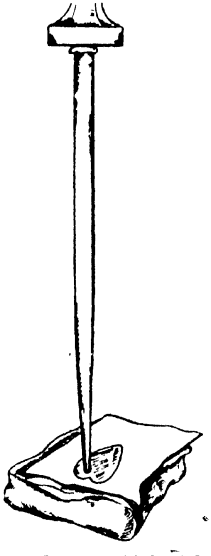
Diag. 76.—Overlay of different Metals.

Many excellent variations of the above processes are possible: also perforated overlays of different metals may be introduced to realize colour effects by setting, soldering, or (Diag. 76) riveting.

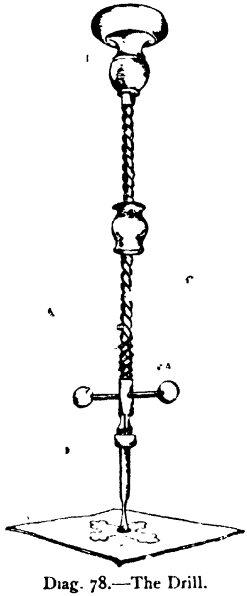
The Metal employed in a pierced decoration must have a smooth

and level surface, combined with a moderate weight, otherwise the work will appear paltry. Therefore, never use a smaller size than 22 B.W.G. brass or copper, and sizes 8 or 9 metal gauge, silver or gold.

Fix the Design on the metal surface with a clean scratched line, using the steel draw-point for this work. The pencil outline is too soft and uncertain, while engraved or chased lines demand an excess of labour in the trimming and finishing of their edges. Likewise, the student will



Diag. 77 —Piercing with Steel Point.



Diag. 78.—The Drill.

attain greater proficiency if trained to cut direct to a simple scratched outline.

Drilling the holes for the "threading" of the fret-saw must be accomplished with a drill, allowing that the details are small. For large open-work the draw-point, well sharpened, may be cleanly driven through the metal, while resting solidly on the lead block (Diag. 77).

The archimedian drill stock (Diag. 78) will prove a most reliable tool in piercing. It is provided with balance weights, immediately above the chuck, which produce a continuous revolving action combined with perfect smoothness.

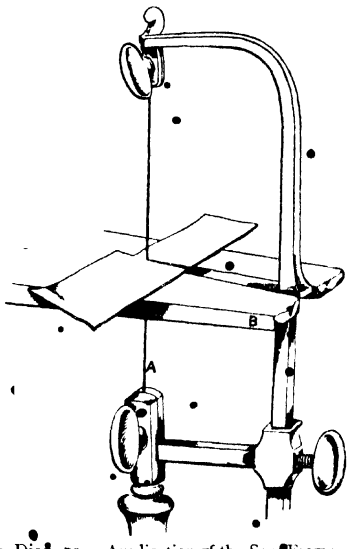
While in use, a little water or a tallow candle applied to the drill-point will serve as a suitable lubricant during the incision of each hole.

The Saw Frame (Diag. 79) will work more effectively if of medium size. If too large, the increased weight and vibration will prove a hindrance to its free and accurate manipulation.

The saw-blades must be chosen to meet the needs and style of the work, and may be purchased by the gross or dozen and in varying grades.

In ordering, always make sure they are for cutting metal, and not for wood.

Fixing the Saw-blade is a most important preliminary to final success. Insert the blade with the teeth pointing downwards (Diag. 79 A), afterwards screwing it tight with the pliers. If too slack it will not cut freely, and if excessively tight it will snap. The blades, although light, with moderate care stand considerable work.



Diag. 79.—Application of the Saw Frame. A, the Saw-blade; B, the Saw-board.

The Saw-board is a projecting piece of wood, the end of which is V-shaped to admit the saw and rest the metal. It may be a fixture or adjustable to the bench or table (Diag. 79 B).

Application of the Saw (Diag. 79).—In the use of the saw, rest it in an almost perpendicular position, and with a light, rapid action cut into the metal. The blade occasionally may be cooled with the finger dipped in water, or beeswax or tallow can be passed over its face, which will result in a freer action and lessen its liability to break. In guiding the saw round acute angles, move lightly and quickly until the blade turns freely.

Fine chasing or repoussé in conjunction with piercing must be executed first, otherwise the work is apt to become puckered, or lose its original shape.

The Cutting Chisel finely sharpened will prove most suitable for piercing grounds in repoussé, while the work is secured to the pitch box, or, if it be a hollow vessel, filled with pitch. Finer work in gold or silver must be fixed on the pitch bowl (Diag. 23).

Hollow Piercings in repoussé or chasing will require a backing of metal to provide strength and finish.

Other examples of piercing and chasing may be studied in the "**Swallows' Flight Pendant**" executed in silver, with finely interlaced wire and seed pearls (Diag. 80); **The "Girls' Guildry Badge"** (Diag. 81); **Celtic Brooch** (Diag. 82); **Gold Brooch, "The Wind"** (Diag. 83); and **Silver Belt Buckle** (Diag. 84).

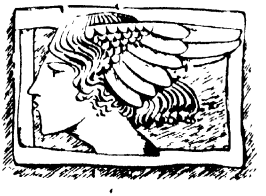
Stencilling on Metal (Diag. 85) with the piercing saw and cutting

Diag. 80.

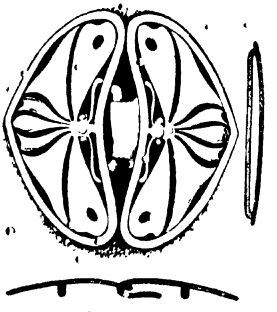
Diag 81.
Designed by Mrs. Fra. H. Newbery.

chisel is largely employed in the construction and decoration of commercial signs, combined with glass and electric light. Many exclusive and unique effects are obtainable with the use of these agents.

Diag. 82.



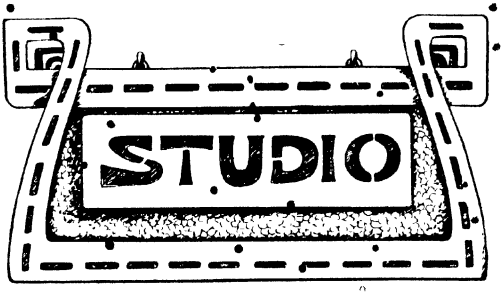
Diag. 83.
Designed by Mrs. Fra. H. Newbery.



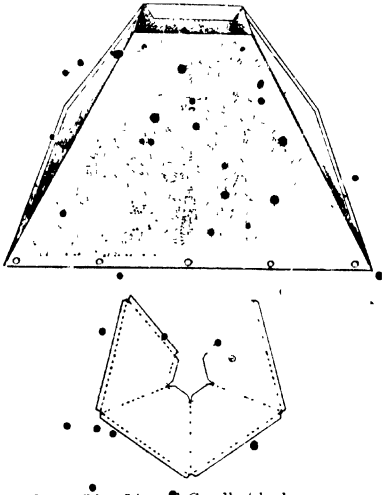
Diag. 84.

Pewter, Copper, and Brass Modelling, combined with perforated decoration, may be effectively applied to interiors, lamp or candle

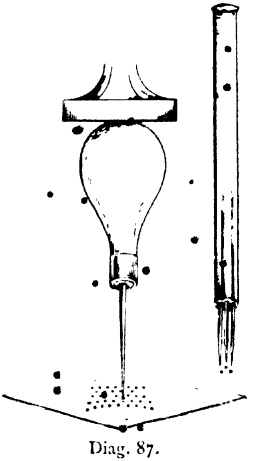
shades, and other work of a similar nature. Diag. 86 illustrates this process as applied to a candle shade. All the piercings are punched through with the steel point or a **Stippling Tool** (Diag. 87)



Diag. 85.—Stencilled Sign



Diag. 86.—Pierced Candle Shade.



Diag. 87.

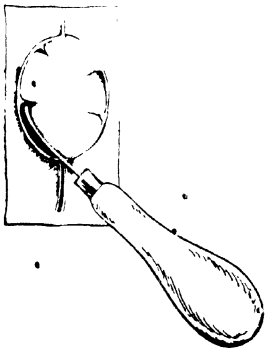
on an extremely thin gauge of metal. The light shining from behind presents the design in silhouette.

The Metal Modelling is executed with the light metal resting on a pad of thick felt, linoleum, or cork.

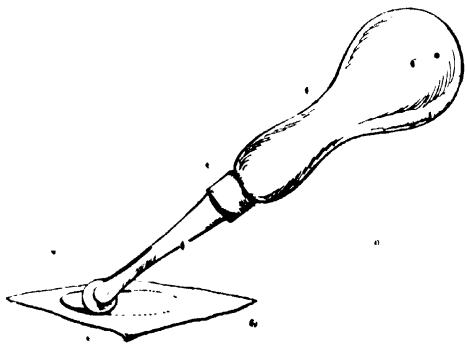
A veiner similar in shape to a burnisher (Diag. 88) will incise the outlines or model any keen edges.

The small "wheel" (Diag. 89) may also serve as an outliner.

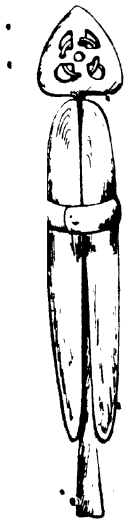
Parts in relief will be attained by the use of the wood or bone modellers.



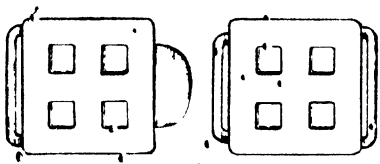
Diag. 88.—The Veiner.



Diag. 89.—The Wheel.



Diag. 91.—Wodden Clamp holding the Work.



Diag. 90.

Diag. 92.—Pierced Napkin Ring in Silver, Repoussé and Champlevé Enamel. *Designed by Mrs. Francis MacNair, and executed by the Author.*

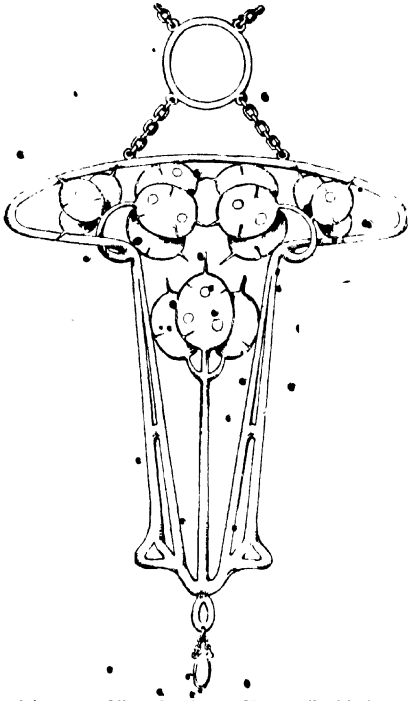
Diag. 93.—Button in Fretted 9-carat Gold (Pale Antique Finish).

The background may be set with a repoussé punch or slightly "stippled" in parts.

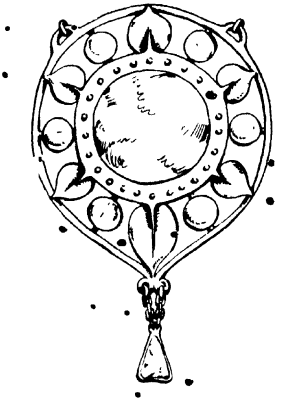
Pewter modelling can be admirably applied to stage jewellery, millinery, and dressmakers' furnishings.

The thin metal, being soft and easily wrought, is liable to suffer in craftsmanship, therefore due care and discretion must be exercised in its use and application.

Exercise in Simple Saw Piercing.—Diag. 90 presents a **Belt Buckle**



Diag. 94.—Silver Pendant "Honesty" with Opal.



Diag. 95.—Pierced Silver Pendant with Amethysts and Blister Pearls.
Designed by Miss Ann Macbeth, and executed by the Author.

with a plain fretted decoration. The catch and side fasteners are all cut from one piece of metal.

Use, if in silver, size 10 metal gauge, and size 20 B.W.G. if in copper or brass.

Its success is mainly dependent upon accurate piercing, with neatly trimmed and bevelled edges.

The catch will be "tapped" over with the horn mallet when held with the pliers or wooden clamp (Diag. 91).

The concluding diagrams will convey several varied suggestions in pierced decoration.

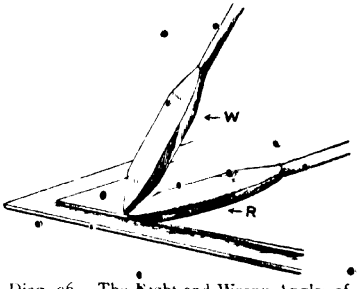
CHAPTER X

SOLDERING—HARD AND SOFT

The process of soldering embodies the uniting of separate parts in metal by the agency of a prepared fusible alloy, combined with a suitable flux. Its practice is simple, but certain specific rules must be followed to ensure success; care, cleanliness, and a correct concentration of the flame being the principal.

The process may be divided into two classes, *hard* and *soft* soldering.

Soft Soldering is the simpler; it demands less heat, or preliminary preparation. The solder in use is mainly alloys of lead, tin, and bismuth, all fusing at a low temperature. This medium will not stand annealing, or the enamel kiln; therefore never permit soft solder to come into contact with gold or silver, unless in the execution of an unavoidable repair. Its impurity would prove detrimental to the precious metals.



Diag. 96.—The Right and Wrong Angles of applying the Copper Bit.

The Copper Bit, Bolt, or Soldering Iron is the special medium used in transferring the necessary heat to the parts intended for soldering (Diag. 96).

For general work a copper bit of a fair size is preferable; this ensures a well-sustained heat. In soldering light or delicate work, a jeweller's bit will be necessary (Diag. 97). Heat the bit over a covered gas-ring, or insert it in an open fire.

Tinning the Copper Bit.—The copper bit when new is generally devoid of solder; therefore, before using, a film of tin must be transmitted over its face. This process will also serve as a practical introduction to soft soldering.

Previous to the heating of the implement, sprinkle a small quantity of powdered resin and sal-ammoniac, to act as a flux, over a scrap of copper or brass. Having heated the copper bit to a uniform dull red

Diag. 97.—The Jeweller's Bit.

shade, quickly clean its tapering face with a rough file, and with a strip of soft solder resting on the metal scrap embed the nose of the copper bit. The solder will immediately fuse; while in this condition rub the bit throughout the solder and flux, which will result in a clean even film becoming diffused over its surface.

Re-tinning will seldom be required, admitting sufficient care is exercised when heating the bit. Over-heating always proves detrimental to this implement.

The copper bit, with frequent use, may show signs of becoming blunt; remedy this defect by forging and filing it to a smart taper, afterwards re-tinning as directed.

The Flux.—Several mediums are available as a flux in soft soldering, the principal being "killed spirits," resin, tallow, sal-ammoniac, and fluxite.

For all general work, including brass and copper, the spirits will prove thoroughly reliable. Fluxite for certain types of work is preferable; notably in soldering in clock movements, or similar mechanical parts, where "sputtering" of the medium would prove injurious to the work.

A Fluxite Paste may be prepared from—

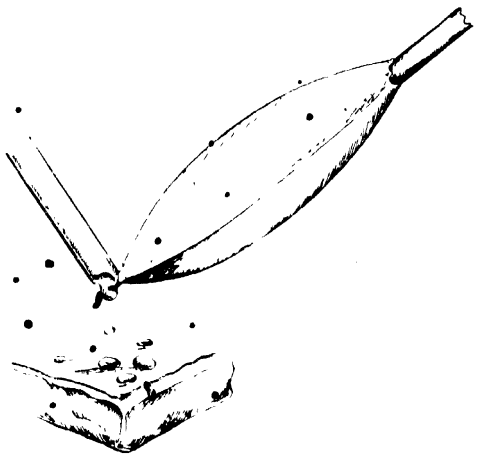
"Killed spirit"	1 part
Vaseline	2 „
Sal-ammoniac	½ „
Methylated spirit	1 „

Prepare the "killed spirit" by pouring a quantity of spirits of salts, muriatic or hydrochloric acid, into a bowl; afterwards add to this liquid a quantity of clean zinc cuttings. On immersion the ingredients will immediately commence to "live" (*i.e.* to effervesce); now place the bowl in a suitable position where the obnoxious fumes will escape freely. When the addition of zinc produces no further ebullitions, the liquid may be strained off and bottled for future use. The addition of

a small quantity of sal-ammoniac will vastly improve the soldering fluid.

While in use keep the soldering fluid in an open, shallow vessel. The stem of a clay pipe will make an excellent "dripping rod" in its application.

The Soft Solder is more easily utilised in the form of narrow rods, or circular "blobs," which are made by inserting the nose of the hot bit into a rod of solder, and allowing the fused medium a few inches of a drop, which will result in the formation of beads in metal of varying size (Diag. 98). These may be retained in a box for future use. In this condition they may be readily applied to any part of the work with the pliers or tweezers, and are indispensable in "tacking" loose parts in position before finally soldering (Diag. 99). Prepare the solder by melting in an iron ladle, with the addition of a small quantity of resin. When all the mediums are perfectly alloyed, skim off the surplus dross with a wisp of brown paper, before pouring it out in long, narrow strips.



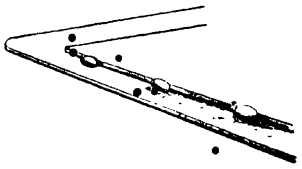
Diag. 98.—Formation of Beads.

Suitable Soft Solders.—One part of lead, 1½ parts of tin. For finer work, 1 part of lead, 2 parts of tin.

NOTE.—If for blow-pipe work, add a small quantity of bismuth.

For Soldering Pewter.—One part of lead, 1 part of tin, 2 parts to 2½ parts of bismuth.

Bismuth will soften, and antimony harden, the tin.



Diag. 99.—Blobs of Soft Solder in position for "Tacking."

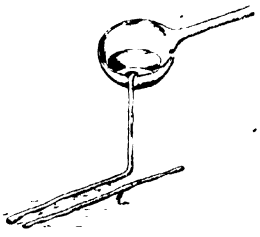
In preparing the solder for pewter, first melt the lead in an iron ladle, afterwards inserting the tin, and finally the bismuth, with a sprinkling of powdered resin. In soldering pewter, special care must

be exercised, owing to its low melting point; also apply the soldering bit with a delicate touch, and use a little tallow, or gallipoli oil, as a flux.

Long rods of soft solder may be easily cast by pouring the metal through a tapering cone of cardboard, and allowing it to "quench" in a deep bottle.

Iron ladles can be obtained with a small circular "pour" specially adapted for the preparation of soft solder (Diag. 100).

The Process.—After cleaning the metal, apply the "spirit" over all parts intended for soldering. Wipe the nose of the hot bit with a rough rag, or if very dirty, use a rough file, afterwards resting it on a "blob" of solder, which will readily adhere until placed in position for use.



Diag. 100.

Carefully observe Diag. 96 R and W, illustrating the right and wrong angles for the application of the copper bit, which, if held too high, loses the full concentration of heat.

Apply the medium as directed until the solder fuses, then slowly move it along the seam, fusing each "blob" in rotation, until all is sound and complete.

The gas blow-pipe may be successfully used in soft soldering, especially in "sweating" the solder into large seams or joints.

A cleaner soldering will be obtained if a small brush previously dipped in the soldering fluid is wiped lightly over the fused solder.

Avoid an excess of solder, which means unclean work, with additional and unnecessary cleaning. After soldering, wash the work thoroughly with a brush and hot water to remove all traces of the spirit.

Small seams may be neatly soft-soldered by inserting a narrow strip of tinfoil, with a dusting of resin along the joint. A light application of the flame will sweat the solder cleanly and evenly into the desired parts.

Tinning the interiors of cups, bowls, tea caddies, and spoons in the baser metals, must be resorted to, with the object of rendering them perfectly clean. They may also be gilt, or silver-plated.

The surface intended for "tinning" must be thoroughly scoured with emery, sand, or powdered bath-brick, before the application of the tin. Over this prepared surface give a wash of the "killed spirit," and a dusting of sal-ammoniac. Several "blobs" of tin can now be placed on the metal, and fused with the gas blow-pipe. A few deft, circular

sweeps with a ball of finely teased tow will effectively transmit the medium in a clean silvery layer. Any irregular parts occurring may be reheated, and the process repeated.

If tinning is only required on certain parts, protect other surfaces with a paste of whiting and water.

Cleaning and Repairing the metal surface after soldering can be easily attained by the use of a shave-hook and scraper (round and flat) (Diags. 68 and 70).

The Shave Hook is essentially a tool of the plumbing craft, but in working soft solder it is indispensable. The rasp, old file, and graver may also be utilised in repairing any excess, afterwards smoothing up with emery cloth. Corners or intricate detail may be smoothed up with pumice stone (lump) and water-of-Ayr stone.

In soft-soldering copper work, any "white" seams may be coloured with sulphate of copper, moistened and applied to the required parts.

Tin, or similar alloys, may be removed from the precious metals by scraping, afterwards applying a few drops of nitric acid to the affected parts, and allowing it to act until all residue is removed.

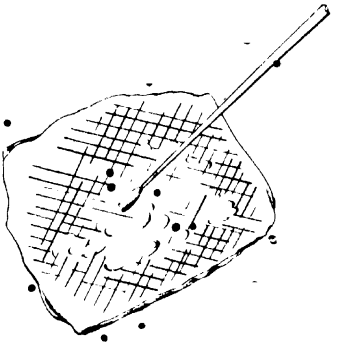
Avoid annealing the work; soft solder, if heated, tends to eat into the metal. When undoing soft soldered parts, wash the seams with the "killed spirit," and suspend over a Bunsen burner, or apply the blow-pipe flame gently, when the seams will open apart.

Hard Soldering requires the use of an alloy which will stand passing through the fire, or the enamel kiln.

The blow-pipe is generally used in hard soldering, especially on gold and silver.

The baser metals, brass, copper, and steel, are usually brazed with spelter, over a forge or blast fire.

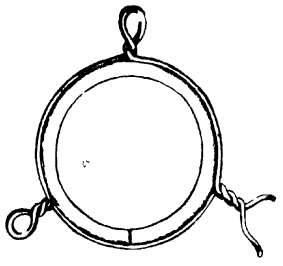
The Flux in use for hard soldering is borax, or a soldering fluid with that medium as its base. Borax is the most perfect flux in the protection from oxidisation of a metal surface. For small work it may be used in lump form, and ground as required by rubbing with water on a borax dish or slate (Diag. 101), until a thin, milky fluid is produced. The borax slate is simply made by scratching incised lines with a steel point on a scrap of slate.



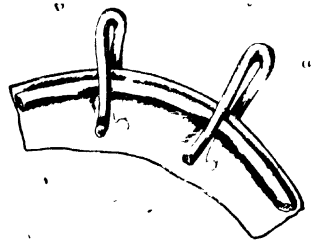
Diag. 101.—The Borax Slate.

For work of large dimensions the borax will act more freely if brought to boiling point in a pan containing sufficient water to cover the medium, afterwards stirring the liquid until it sets in a snowy white mass. It may then be bottled, and used as required with a small quantity of water.

Clean the Metal at the parts intended for soldering by scraping or filing their surface. Care must be exercised in the joining of edges to file away any surplus rim, or iris of metal, which would intercept the solder when fused. Fit the edges closely, but with a slight "burr" on their surfaces, which will, when knit together, result in a clean and sound soldering. As a general rule boil out in the sulphuric pickle after each soldering, as perfect cleanliness is necessary to success. Separate



Diag. 102.—Iron Binding Wire (Method of Looping).



Diag. 103.—Clamps in position.

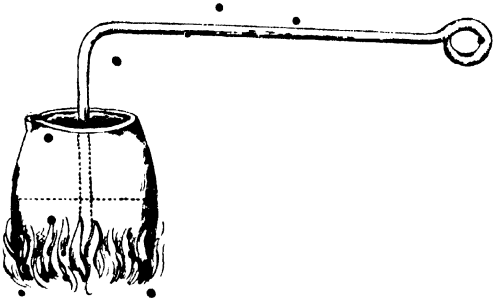
details, to ensure their position during soldering, must be secured with iron binding wire, size 20, loops being made at intervals to admit of the separate parts being tightened as required (Diag. 102). Heavier work, comprising solid wires, will require the use of iron clamps to maintain their position during the process (Diag. 103). Always remove all binding wire or clamps from the work before pickling, to avoid discoloration. A cleaner surface of metal will be obtained if, after soldering, the work is allowed to cool before boiling off in the pickle. Never permit work with hard-soldered joints to remain an indefinite time in the sulphuric pickle, as the action on the solder would be detrimental.

The Solder must be prepared in different grades—hard, and easy flowing—to suit different types of work; otherwise if a soft alloy were used for enamel work, the seams would be liable to give way in the kiln. Light details in jewellery demand an easy flowing solder. With the above object in view all filings or "lemel" may be retained for converting into solder. Practical work may be commenced by fusing down small quantities of silver cuttings, combined with fine brass and

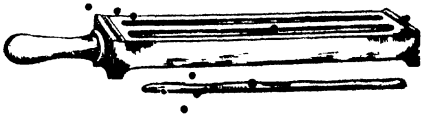
a little powdered borax in proportions of 1½ to 5 parts silver cuttings, and 1 part fine brass.

The correct quality of brass may be obtained by purchasing scraps of fine brass netting. In melting, add the brass after the fusing of the silver, and immediately before pouring. This precaution will minimise the risk of oxidisation of the zinc, which would injure the melting point of the solder.

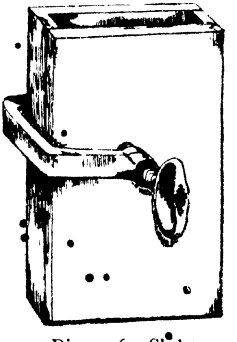
Larger quantities must be fused in the crucible, with the gas blow-pipe, small forge, or blast fire. When melted, stir and skim off any dross with a hot spatula made from iron wire (Diag. 104). Pour the



Diag. 104.—Iron Spatula for skimming the Dross off Molten Metal.



Diag. 105.—Ingot.



Diag. 106.—Skelat.

alloy when in a "live" or boiling condition into a hot, well-oiled ingot (Diag. 105), or skelat (Diag. 106).

These forms of the alloy may be forged thin with the hammer or drawn out with the draw-plate and tongs (Diag. 173).

Never pour molten metal over a cold surface, as it will inevitably "sputter."

Work requiring repeated solderings must have the completed parts well protected with loam (moulding sand or rouge and water in the consistency of mud) to prevent them "giving" when again heated up.

Suitable Solders—

	oz.	dwts.
Fine Silver	2	10
Fine Brass	0	10
Oz.	3	0

For Enamelling—

	oz.	dwts.
Fine Silver	1	0
Alloy Copper	0	3
Gold, 9 ct.	0	3
	1	6

For transparent enamel use 9-ct. gold solder.

Diag. 107. Adaptation of the Asbestos.

Spelter is a granulated form of copper and zinc, in proportion of 4 parts of copper, 3 parts of zinc.

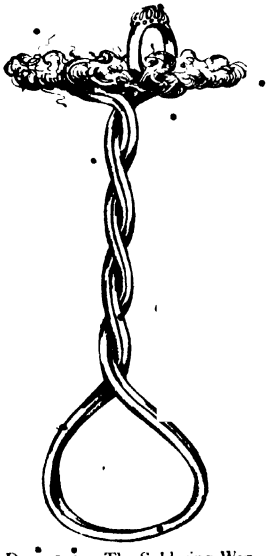
The Charcoal Block (concentrated) will prove the best base as a heat conductor in the soldering of small objects. Cavities and trenched moulds of various shapes may be incised on its surface, and metal castings obtained from them. Sheet asbestos is a convenient support when small details require propping at a certain angle (Diag. 107). For larger work the revolving soldering table with fireclay slabs is necessary (Diag. 108). Broken enamel muffles or crucibles provide good material for its surface. Rings, bracelets, or similar objects can be readily secured on the mop or iron soldering wig (Diag. 109). A lump of pumice is also a useful base on which to solder.

Diag. 108. The Soldering Hearth or Table.

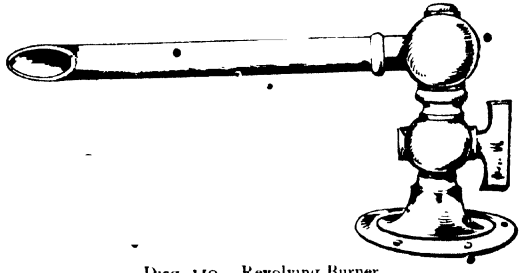
The Gas Blow-pipe (Diag. 25), with adjustable tap, and foot-blower to regulate the size of flame and extent of blast, is an indispensable agent in the process of soldering. In practice, observe the rule never to use the mouth blow-pipe where the gas blow-pipe can do

the work. In purchasing a blow-pipe, choose one of fair size; C. 40 (Fletcher Russel), with suitable bellows, can be adapted to all types of work, and is worthy of recommendation.

For work with the mouth blow-pipe, the revolving bench burner (Diag. 110), fitted to the table, will be most suitable, or, as a substitute, the ordinary branch gas-bracket minus the burner may be employed.



Diag. 109.—The Soldering Wig (method of adapting).



Diag. 110.—Revolving Burner.

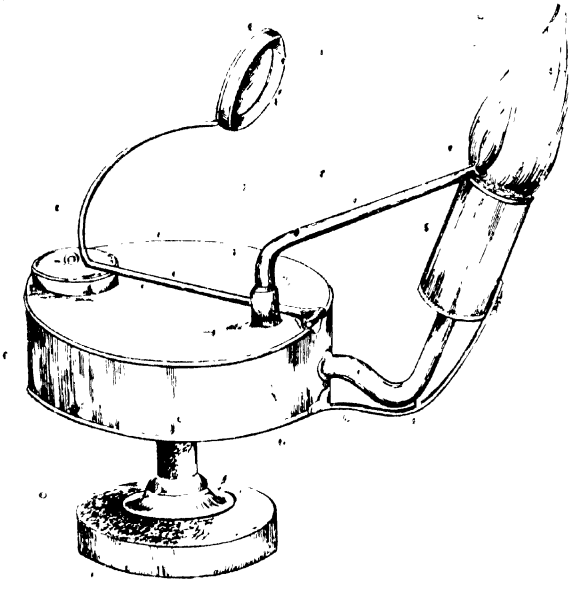
In using the mouth blow-pipe, practise holding it between the teeth, which will permit a free use of the hands. Two sizes are preferable for large and small work: purchase one with a pin point outlet for gold work.

A blow-pipe with a vulcanite mouth-piece is preferable for the sake of cleanliness. The oil or spirit lamp (Diag. 111) is capable of good work, but both are unsuitable for heavy work.

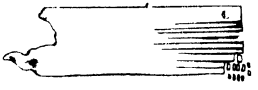
The spirit lamp (methylated spirit) is cleaner, and for light jewellery will give satisfaction; however, when gas is obtainable, never supplant it.

The charcoal fire or forge was mainly in use in the earlier days, but speltering is still executed over a forge, or blast fire. The solder should be applied in the form of paillons (that is, small panels or snippets) for small work (Diag. 112). However, if the object is of large dimensions

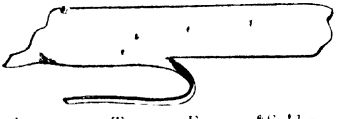
a long tapering finger of solder is the most serviceable (Diag. 113). Avoid curls of solder (Diag. 114) which are inevitably singed during the process and their fusibility impaired.



Diag. 111 — [illegible]



Diag. 112.—Paillons of Solder.



Diag. 113.—Tapering Finger of Solder.

In soldering fine detail, filigree, or cloisonné wire, melt the borax to a glaze in a porcelain dish or saucer (not on metal).

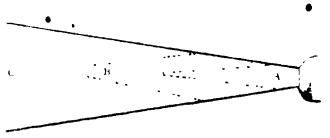
Diag. 114.—Curls of Solder.

Afterwards grind the borax glass resulting from the process to a fine powder with the pestle and mortar.

Now reduce the solder intended for use to a fine powder with a file. Mix the two ingredients equally and apply the powder evenly along the joints.

Apply the heat where convenient from the under side of the work, which will minimise the risk of displacing small details.

The Process of soldering will be greatly simplified if due study is directed to the exact point of contact in the flame, which is necessary to obtain the greatest degree of heat. Diag. 115 presents three sections of flame, composed of varying shades and degrees of heat. The inner section A is composed of unburnt gas and air emerging together from the nozzle of the blow-pipe. In the centre, section B, active combustion has set in, while in the remaining section C combustion is in progress to a limited extent only (the cooling process has set in here, producing a smaller burning area). The tip of the centre section B is, therefore, where the greatest heat exists.



Diag. 115.—The Sections of the Blow-pipe Flame, A, B, and C.

In the first application of the flame carefully avoid a sudden blast, which would be liable to disturb the solder with the boiling of the moistened borax.

Aim at uniform soft waves of flame, and mainly over the heavier part of the work: when all is gradually heated up, then concentrate the correct flame with an equally strong blast to the solder, which will fuse, and result in a clean and sound joining. In soldering small work, apply the borax sparingly and in a thin liquid, otherwise it will boil up, and displace the separate details. In constructional work with numerous solderings, build up and solder the heaviest parts first, also protect each completed seam with loam. For extremely fine details an easy flowing solder may be introduced.

Brazing with spelter will be more successful if executed over a coke fire, or clear forge.

The solder and borax may be prepared half and half with the minimum of water, and laid along the seam in a narrow ridge; also bind separate parts with iron binding wire, size 20, B.W.G., before soldering. Heat the work gradually from underneath until almost white heat, at the same time throwing an occasional "pinch" of dry powdered borax along the joint, which will greatly accelerate the fusing of the spelter.

The spelter is mainly used in joining brass, German silver, copper, and iron, also in working with the "lap," or interlocking joint (see Chapter XIII.).

Repairing includes the filing away, and smoothing of all surplus solder.

Files, rough and smooth, together with a scraper, will be required in this process. Parts of a decoration defaced with the solder can be retouched with the chaser's punch and graver, afterwards being smoothed with pumice and water-of-Ayr stone. If tin or a similar alloy get "caught" on gold or silver, it may be removed by scraping clean, and applying a drop of nitric acid. If a large part is covered with tin, scrape it as clean as possible, and apply hydrofluoric acid and fluor-spar, combined with hot water, allowing this liquid to remain on the discoloured parts until the tin is fully removed.

Never attempt hard soldering where tin exists without first removing it perfectly from the metal surface.

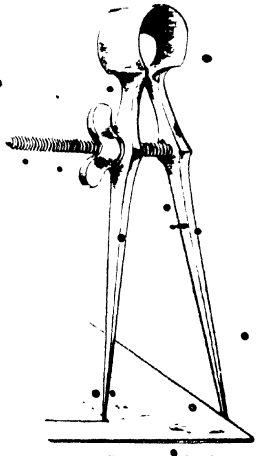
On the precious metals its effect is most deleterious, and especially if annealing be attempted.

CHAPTER XI

SIMPLE SHEET METAL WORKING

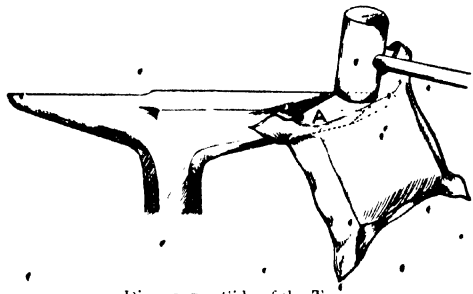
Flat Sheet Metal Work has been chosen as the introductory process in that branch of the craft, chiefly owing to its plain constructional work and all-round utility. The basis of the work embraces the principal methods in vogue among the past and present craftsmen, irrespective of whether the medium used is of the precious or the baser metals.

Ash Tray or Pickle Pan (Exercise I.).—The execution of the above exercise, while affording a useful lesson, will also provide an article of utility without entailing any unnecessary finish. It may be made in either brass or copper, and in size about 4 or 5 inches square with its border ¾ of an inch deep. Size 22 will provide sufficient strength. Cut the square of metal with the shears, and trim its edge with a file; afterwards set the steel dividers to the breadth of the border, and run them down the edges of the square (Diag. 116), which will result in an inner parallel line being drawn. This line (Diag. 116), will form the base of the tray when complete. Commence drawing up the sides of the tray by resting the line A (Diag. 117) on the edge of the beck iron, or similar right-angled form, and apply fairly heavy blows with a wood or horn mallet along the narrow strip of metal which will form the sides (Diag. 117). The beginner will experience the greatest difficulty with the excess metal collecting at each corner. This obstacle will be considerably lessened by cutting off with the shears the sharp projecting corners, and rounding them with the file till a soft, agreeable curve is attained. Continue "tapping" up the sides, until a smart sloping



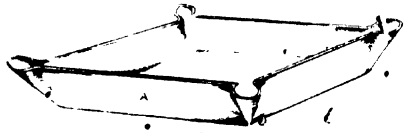
Diag. 116.—Drawing the Edge with the Steel Dividers.

rim is formed (Diag. 118 A): afterwards model the projecting ears of the tray over the round tapering arm of the beck-iron (Diag. 119). During the progress of the work annealing must be resorted to at regular intervals, which will retain the metal in a ductile condition. In bending sheet metal to right angles, always score the inner line with a sharp incision. This will be accomplished with a scoring tool, or sharpened end of a file; this incision will assist greatly in bending the metal.



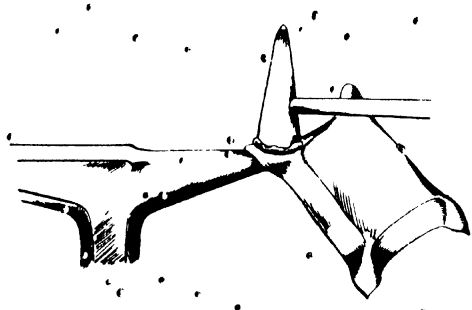
Diag. 117.—Side of the Tray.

Templates, or Cards of thick paper, will simplify the work, and prove reliable guides in spacing off flat constructional work previous to the cutting of the metal. Diags. 120A, 120B, 120C, will convey their special advantage in the planning of boxes, while Diag. 121 represents the card required for a candlesconce nozzle.



Diag. 118.—The Curved Corners. A, Sloping Rim.

The Finish of the Metal Edges.—Metal edges, after cutting with the piercing saw or shears, must be nicely smoothed off to a smart bevel, half-round, or fully rounded edge, otherwise they will lose in outline, and suffer in effect.

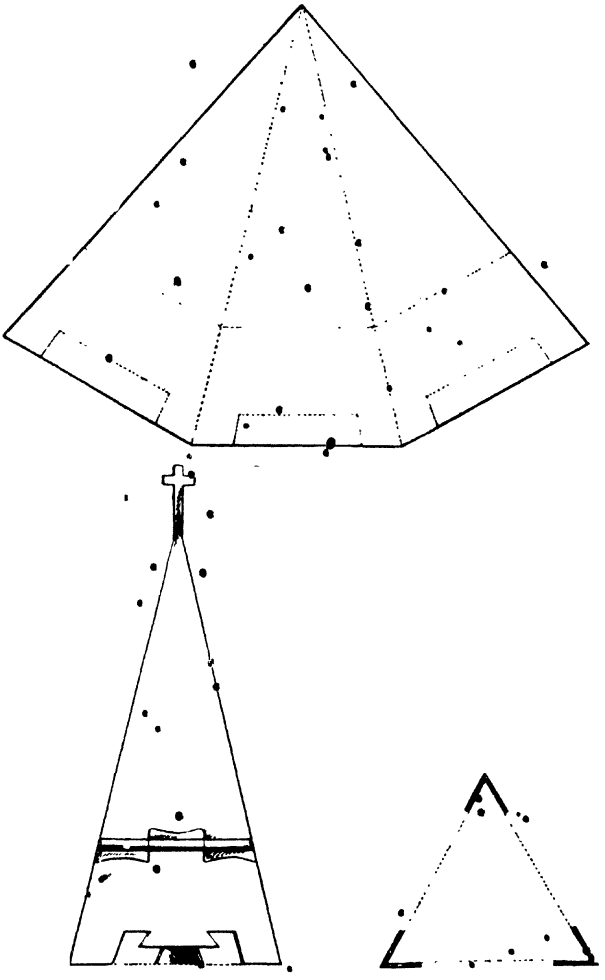

Diag. 119.—Modelling the Corners.

Diag. 122A represents the raw untrimmed edge of metal, as compared with the smartly finished effect of A, B, C, D, and E (Diag. 123).

The above results are obtained entirely with the use of a file. However, their breadth and effect can be strengthened if the steel hammer is previously utilised in their formation.

In filing metal edges, wooden clamps may be used for securing the work, which will prevent the bruising of the metal (Diag. 91).

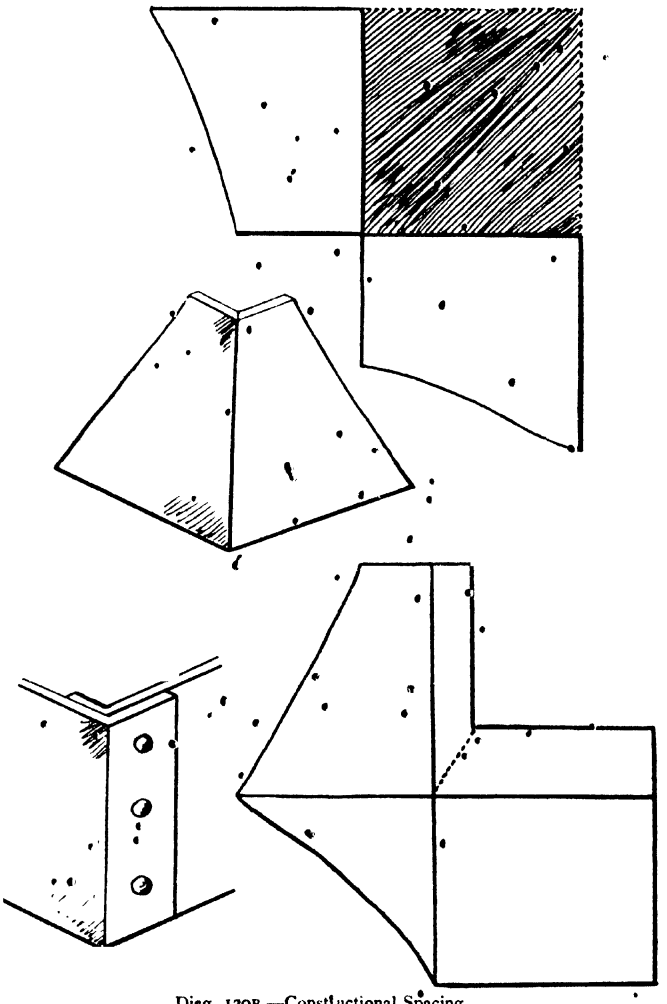
Lapped Edges are productive of many pleasing, decorative effects,



Diag. 120A.—Constructional Spacing.

combined with sound constructional work. Diag. 124 will convey several typical examples of the varied possibilities arising from the

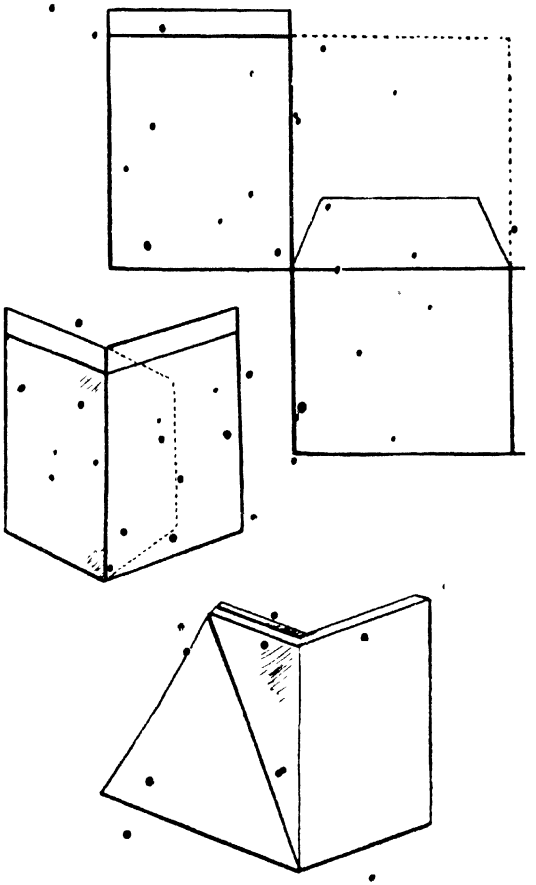
xercise of this process. The pattern and design are entirely the



Diag. 120B.—Constructional Spacing.

outcome of tools and material. In "tapping" over the above edges, use the wooden mallet, with the metal resting solidly on the beck iron

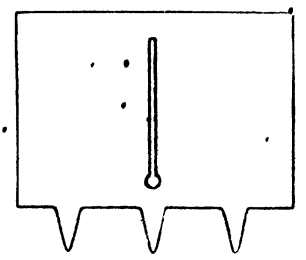
or bench anvil (Diag. 125 A, B, and C). This marginal decoration, after hammering, may be "tacked" with a paillon of solder or secured with a rivet (Diag. 126).

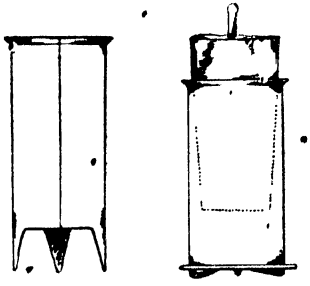


Diag. 126.—Constructional Spacing

The Wiring of an edge in sheet metal is one of the most important processes of the craft. In the gold and silver-smithing branches "mock" or tubular wires are seldom introduced, unless in the form of cheap spun-work produced on the lathe.

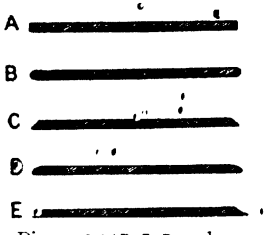
Solid wiring is almost exclusively applied to the precious metals where solidity and purity are essential.



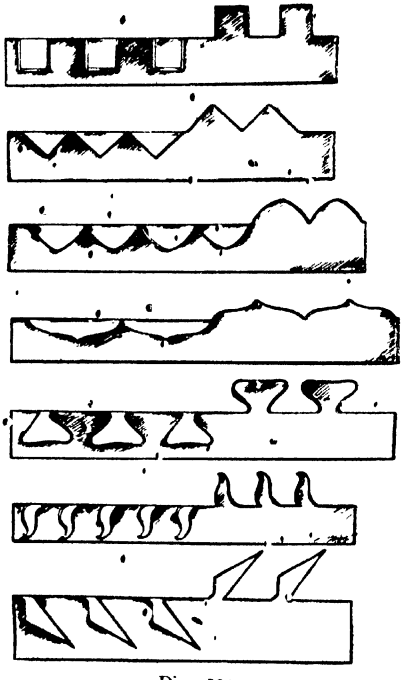


Diag. 121.—The Candlesconce Nozzle

Diag. 122.—A, Untrimmed Edge.

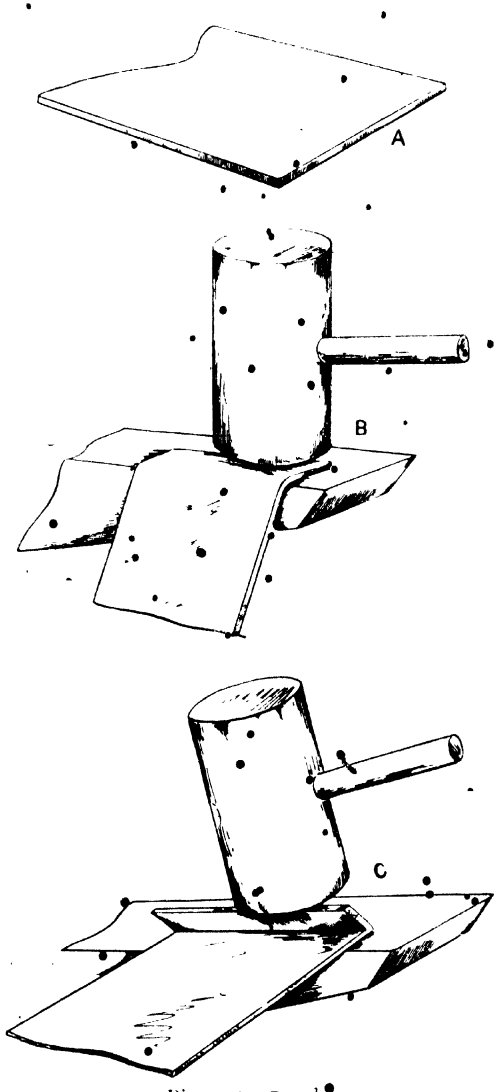


Diag. 123 A, B, C, D, and E.



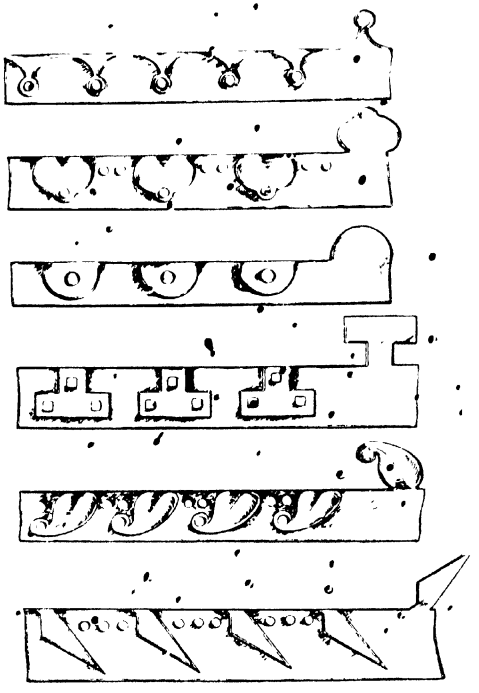
Diag. 124.

These wires are chiefly the product of the steel draw-plate, swage-plate, draw-bench, and draw-tongs (Diag. 172). They may be wrought in all manner of shapes (see Chapter XV.)



Diag. 125 A, B, and C.

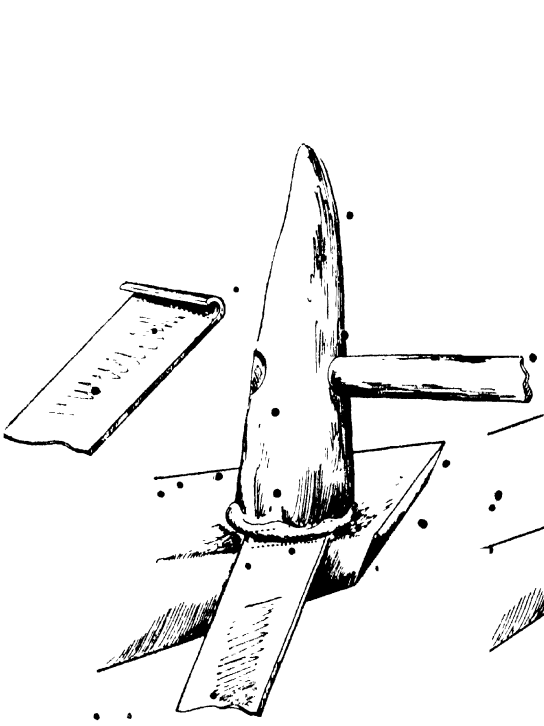
The Process of Mock Wiring is mainly in vogue with the tin and copper-smith; however, in all metal working it is a necessary branch of the craft. Previous to wiring an edge of metal, anneal it thoroughly; afterwards decide upon the breadth of wire required. Then procure a length of solid wire as a mandril, slightly finer than the diameter of the



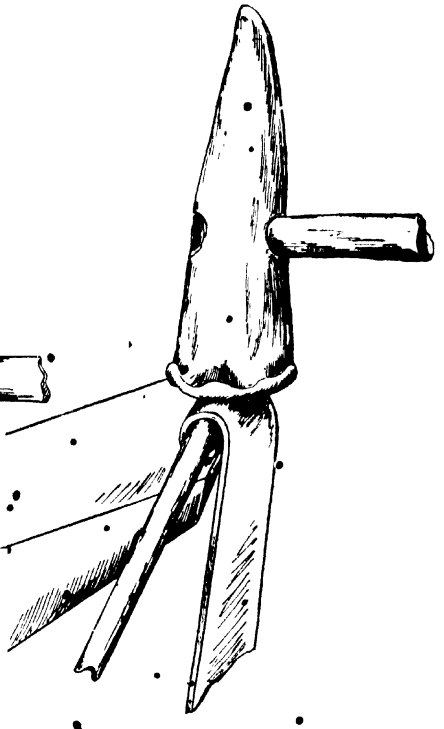
Diag. 126.—Adaptation of the Rivet in a Lapped Decoration.

tube. Mark off with the steel dividers a breadth of three times the diameter of the mandril; now draw the above breadth all round the edge of metal intended for wiring, and commence drawing over this margin on the beck-iron or hatchet stake (Diag. 127), with a flat wooden or horn mallet. When half-curved, insert the mandril, and continue drawing over the sheet metal until the wire is well formed and complete (Diag. 128).

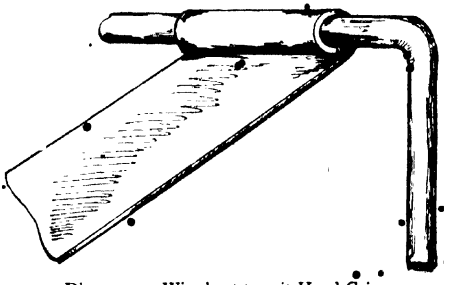
If special strength is required, the solid wire may remain in the tube.



Diag. 127.—Early Stages of Wiring.



Diag. 128.—Drawing over the Tau



Diag. 129.—Wire bent to suit Hand Grip.

In withdrawing, bend the end of the mandril to a right-angle, which will afford a reliable grip when pulling it out. If extremely tight, a slight heat, with an application of oil or tallow, will release it (Diag. 129).

The best wire for the above process is ordinary tinman's wire procurable in lengths of varying thickness and moderate in price. Let each student aim at the mastery of this process, as it will prove of great service in making small tubes for joints, hat-pin sockets, brooch mounts, or similar hollow wires, when the use of a draw-plate cannot be obtained.

In Metal Working generally, avoid deeply scratched "guide" lines, sinking of centre marks, or other blemishes with steel dividers, etc.; these unnecessary defects provide worry and loss of time in the finishing process. In trueing the edges of a circle with the file, keep the metal slowly revolving to the right, and the file action towards the left; this application will produce a perfect round.

CHAPTER XII

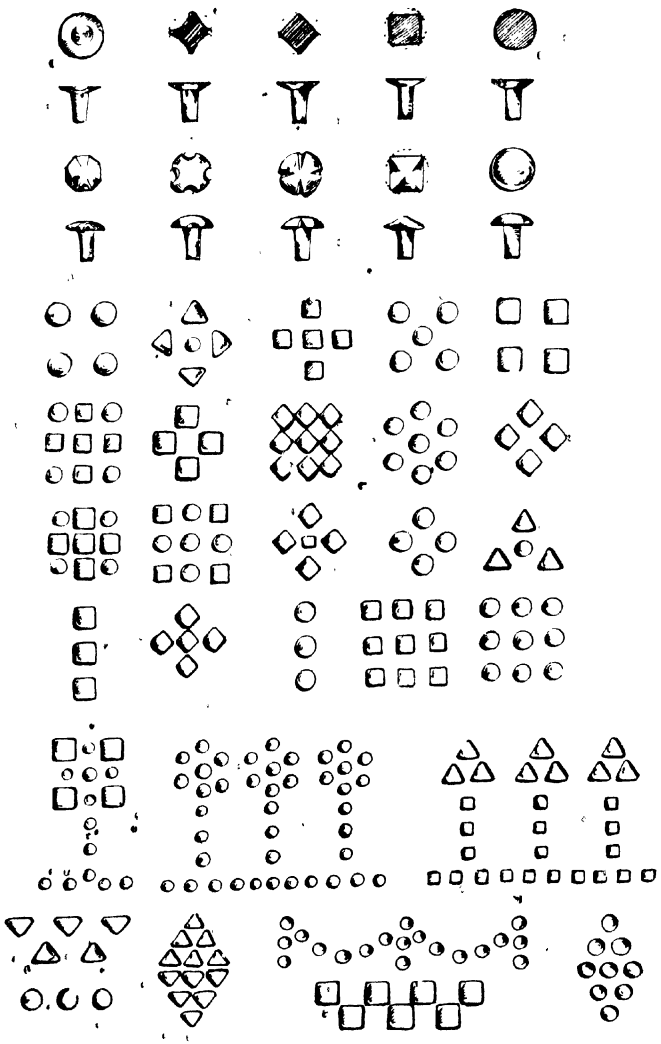
THE RIVET, ITS USE AND ADAPTATION

Constructional and Decorative Value.—The rivet in practical craftwork is seldom applied, or its true decorative value fully appreciated. Its use in many ways is superior to that of solder, while for cleanliness and sound constructional work it is unapproached. As an educational exercise let the student provide himself with several dozen rivets of various shapes, and attempt arranging them into simple groupings, based on the square, triangle, circle, or oval. If pressed through stiff paper their position will be retained, and notes or sketches may be taken. Diag. 130 illustrates several placings, constructional and decorative.

Rivets can be obtained in copper, brass, and iron, also in the precious metals. The different shapes and sizes present further scope for alteration with the file, hammer, and punch. Washers (thin soles of metal which increase the grip of the rivet) may also be introduced with additional decorative effects (Diag. 131). The above results are the outcome, singly and jointly, of the piercing saw, the file, and the repoussé punch.

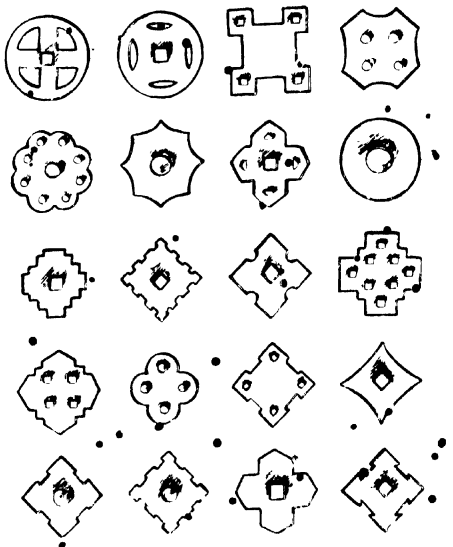
The Process of riveting is simple, and the tools required few in number. The riveting hammer (Diag. 132) has a round and oblong face, slightly full in sections A and B, which, when applied, stretches the rivet head, and locks the separate details together (Diag. 133). The riveting stake is similar in form to the draw-plate, and has cup-shaped depressions of varying size on its surface, which save the round rivet head from bruises during the application of the hammer.

In fixing separate pieces of metal by riveting, first pierce a suitable hole with the drill, or punch them through with a riveting punch, while the metal rests solidly on a steel riveting plate, or on the surface of a lead block (Diag. 134). The above punch may easily be made by the student, the point requiring most attention being its cutting edge, which must have a keen bite.

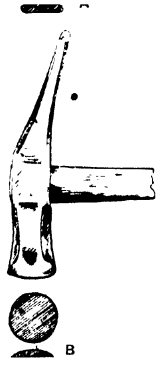


Diag. 130.—Rivets arranged on Cardboard.

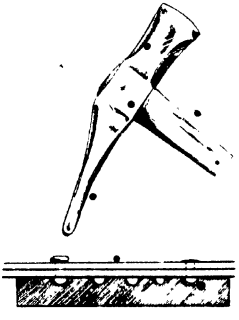
Before applying the hammer blow, make sure the position of the punch is exactly above the cavity in the riveting stake. One blow from a fairly



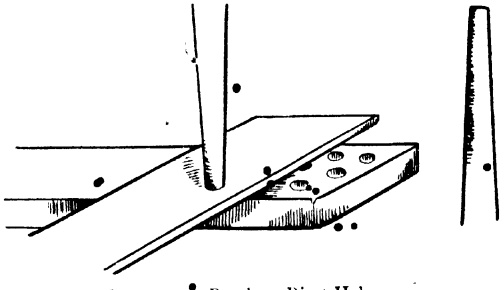
Diag. 131.—Washers as a Decoration.



Diag. 132.—The Riveting Hammer.



Diag. 133.—The Process.



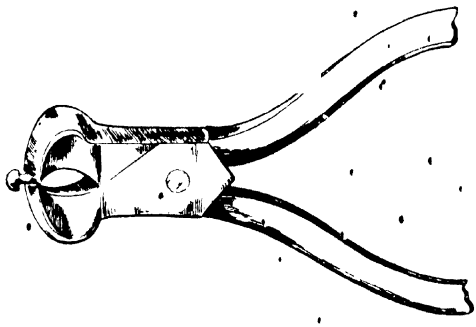
Diag. 134.—Punching Rivet Holes.

heavy hammer will pierce a clean hole to the size and shape of the riveting punch, and with greater speed than a drill.

Any "puckering" of the metal may be removed by a few blows on the

obverse side from the mallet, with the metal resting on a stake or bench anvil.

After piercing the rivet holes, place the separate parts in position, and insert a rivet; if the hole is rather small, ease it slightly with the "reamer," (Diag. 73). If, after insertion, the rivet is too long, cut it with the cutting pliers or nippers (Diag. 135) to $\frac{1}{16}$ of an inch projection, which will provide sufficient margin for "locking" the rivet with a few blows from the hammer.

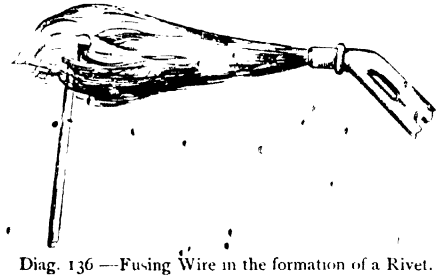


Diag. 135.—Cutting the Rivet with Nippers.

Washers in combination with the rivet are unnecessary in small work, unless a special construction or decorative treatment is desired.

If accidentally a rivet hole is pierced too large, it may be closed slightly by stretching with the hammer, while resting the metal solidly on the bench anvil.

The Rivet and how to make it.—As rivets may be obtained in various shapes and sizes, it is quite practical to purchase those agents. Educationally, however, their production has a certain value to each student.



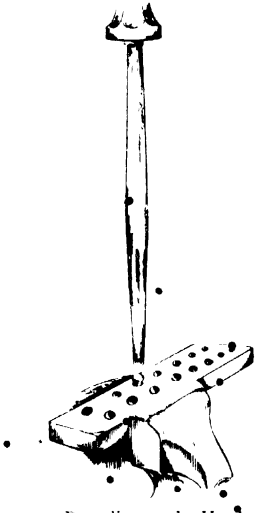
Diag. 136.—Fusing Wire in the formation of a Rivet.

The rivet is produced by rounding up an end of wire with the file, dipping it in the borax paste, and concentrating the blow-pipe flame towards its surface until the metal shows signs of fusing; immediately increase the flame, and raise the wire to a perpendicular position, until a soft bullet head is formed (Diag. 136).

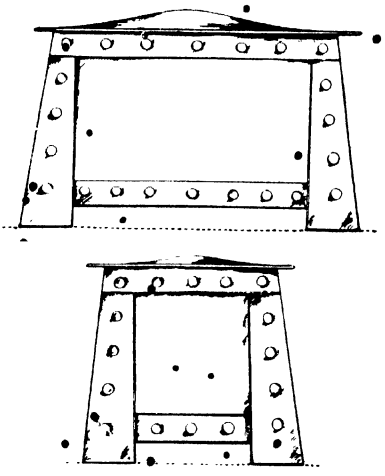
The rivet may now be cut to size, and the head trued up, if required, with the ring or perloir punch, while resting in the riveting stake (Diag. 137). Rivet-making will be unnecessary in the baser metals, owing to the unlimited choice provided, but in the precious metals sizes and shapes are not easily obtained.

Their use in the construction of a Box.—Many dainty boxes of varied shape and size, yet simple in construction, may be produced by the direct application of the rivet independent of solder. Diag. 138 is a typical example of their exclusive use in the binding of a box.

The sheet metal is first set out in plan, and cut direct with the shears. It is then drawn down to right angles with the wooden mallet over the face of the beck iron, or similar square stake. The riveted corners supplant the use of solder; while the joint can be made from a wire and suitable tube, produced by wiring a strip of metal, as fully



Diag. 137.—Rounding up the Head with a Perlour.



Diag. 138.—Box with Riveted Construction.

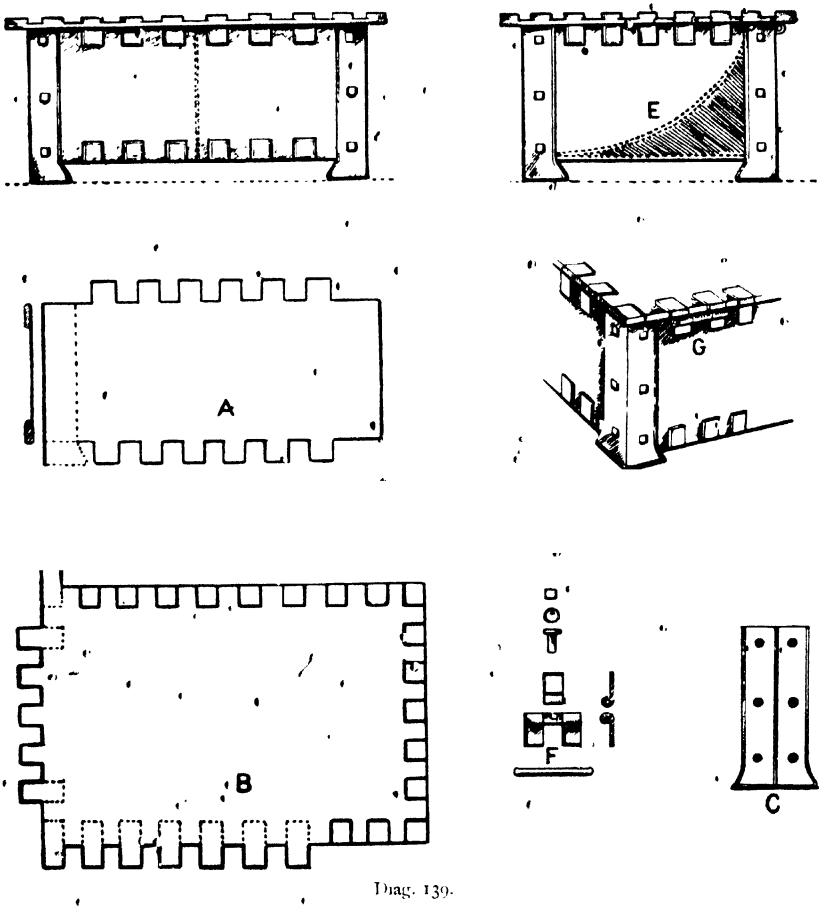
explained in Chapter XI. (Diag. 127), and finally secured to the box by the agency of small rivets.

For boxes not exceeding 10 inches, in the baser metals use sizes 21 or 22, Birmingham Wire Gauge. In gold or silver use sizes 8 or 9, Birmingham Metal Gauge.

Stamp Box (Practical Exercise) (Diag. 139).—Silver, brass, or copper may be used in the execution of this work.

Approximate size 2 inches by 1¼ inch, by ¾ inch in depth (inside measurement). If in silver use size 8, metal gauge, and if in the baser metals size 22, Birmingham Wire Gauge. For the combined corner

and foot employ a slightly heavier size (9 in silver and 20 in brass or copper)



Diag. 139.

Commence work by accurately setting out the various details on the sheet metal.

If in silver, first cut a paper card, A and B, which will provide a reliable guide for the quantity of metal.

The straight shears will cut the main lines; use the piercing saw for the more intricate details.

After cutting the straps which form the corners C, give the centre line on the obverse side of the metal a fairly deep incision with the large straight tracer.

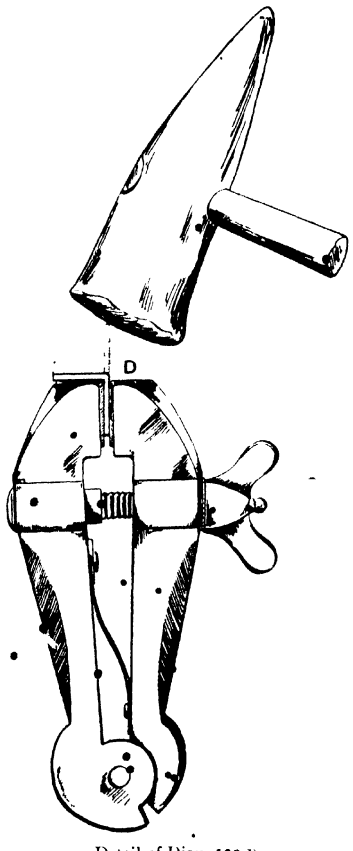
Rest the metal during the above process on the lead block, or secure it on the chaser's pitch-bowl. The groove resulting from the outlining must now be "opened" slightly with the sharp edge of a half-round file, which will relieve the "tension," and allow play for the metal when drawn over to fit the corner. Anneal the corners before tapping them over as illustrated at D, Diag. 139.

Small soft metal clamps may be inserted in the vice to save the metal from bruising. After the correct shape is attained, finish the edges to a smart bevel, with a smooth file; afterwards mark off the position of the rivets and drill the top and bottom holes.

The projecting decoration of squares on the box may now be "tapped" over on a stake, and finally closed down with a light blow from a steel planishing hammer.

With the edges complete, place on one corner, and accurately mark off the position of the top and bottom holes.

Drill one hole and rivet the corner into position. Once secure, the remaining holes can be easily drilled and the rivets inserted.



Detail of Diag. 139 D.

The bottom of the box (if in the baser metals) may be soft-soldered in, or secured with the bottom rivet. A curved section of thin metal, E, hammered hard, may be sprung in to facilitate the removal of the stamps.

The joint F may be made by wiring, but for small shuttings of this type finely drawn tubular wire, or chenier, will make a smarter finish (see Chapter XV.).

In making the joint, fit it perfectly between the over-lapping square decoration (Diag. 139 G), and either rivet or solder it to the body and lid of the box. The pinning of the joint may be left till the final finishing of the work.

CHAPTER XIII

SEAMS AND JOINTS

In all constructional work in sheet metal seams and joints are necessary, unless when the object is spun on the lathe or beaten from the flat, circular sheet. They are of various kinds to meet the requirements of the work, and may be hard or soft-soldered, riveted, welded, or bound by over-lapping.

The general methods are embraced in the following list :—

The Butt or Parallel Joint.
The Lap or Interlocking Joint.
The Counter-sunk Joint.
The Riveted Joint.
The Grooved and Double Grooved Joints.
The Pared-down or Wrought-down Joint.
The Scarf or Wedge Joint.

Their Application.

The Butt or Parallel Joint (Diag. 140) is used generally in silversmithing and jewellery work. If soundly applied, it will be found a reliable hard-soldered seam, and capable of considerable strain. A tube of metal bound with this joint may be wrought on the stake with the mallet or steel hammer without danger of giving way.

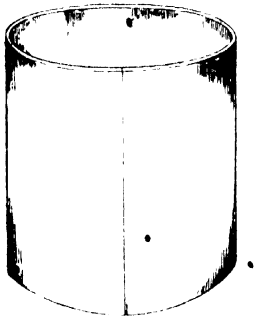
When the seam is soft-soldered it is naturally less robust, and may be used only with the baser metals at parts where no special strength is demanded.

To realise successful results with this joint, aim at carefully fitted seams slightly "burred" with the edge of a half-round file (Diag. 141).

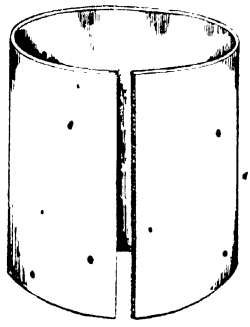
This special preparation will ensure a sounder cohesion of the separate parts with the solder.

The Lap or Interlocking Joint (Diag. 142) is chiefly used in the brazing of copper, brass, German silver, and kindred alloys.

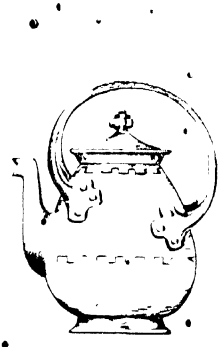
The seam is prepared by filing the adjacent metal to a knife edge.



Diag. 140.—The Butt Joint.



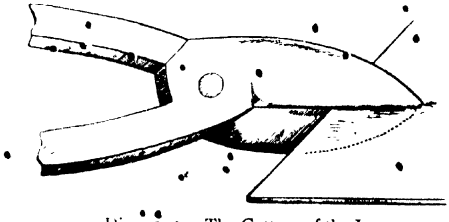
Diag. 141.—The "Burred" Edge.



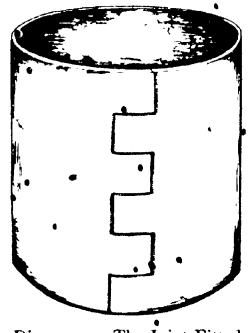
Diag. 142.—The Lap Joint.

One edge is now carefully divided into equal parts, and slit into ¼-inch sections with the shears at right angles to the metal (Diag. 143).

The laps are now locked above and below alternately until the seam is complete (Diag. 144).



Diag. 143.—The Cutting of the Laps.



Diag. 144.—The Joint Fitted.

If the joint appear open, rest it solidly on a tapering round stake and close it with a few light blows from the mallet previous to soldering. The joint, carefully fitted, must now be secured with iron binding wire, well charged with the borax, and soldered as already described in Chapter X.

After boiling out, remove all surplus solder with the file. Any undue unevenness may be smoothed off with a light application of the small steel planishing hammer, with the seam resting solidly on the stake.

The above seam will prove the most reliable for all enamel work.

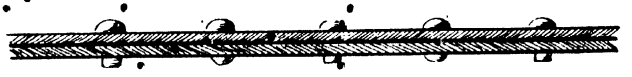
The Counter-sunk Joint will maintain a level surface of metal after soldering, combined with an increased strength.

One edge is bent to a right-angled step of a depth equal to the thickness of the metal; the other edge, resting on this step, gives a level surface when soldered (Diag. 145).

Diag. 145.—The Counter-sunk Joint.

This form of joint is generally applied to soft-soldered work only.

The Riveted Joint consists in lapping one surface of metal above another, and uniting the separate parts by the insertion of rivets, as fully described in Chapter XII. (Diag. 146).



Diag. 146.—Riveted Joint.

The Grooved Joint implies the drawing of one metal edge over and under the other, as illustrated in Diag. 147.

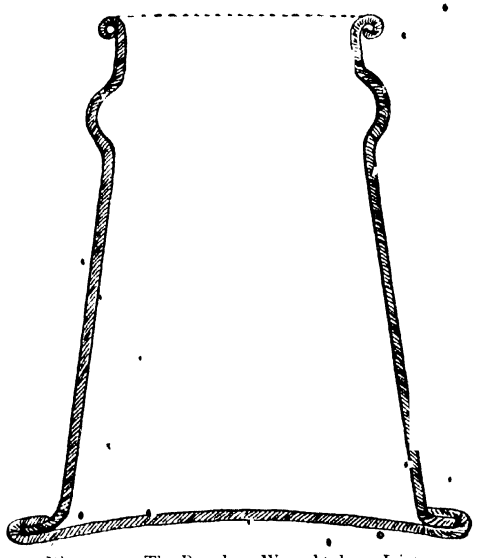
Diag. 147.—Grooved Joint.

The edges, previous to soldering, are closely hammered together with the mallet. A small piece of soft solder is then "sweated" into the seam for greater security.

Diag. 148.—Double-grooved Joint.

The Double-grooved Joint (Diag. 148) is simply the compound treatment of a grooved joint. If properly executed, the solder may be dispensed with, as the joint should be already water-tight.

The Paned or Wrought-down Joint is extremely serviceable in securing the flat bottom of a flower pot, box, or similar object (Diag. 149). In its application, soldering may be dispensed with.



Diag. 149.—The Paned, or Wrought-down Joint.

The Scarf or Wedge Joint resembles the butt joint, only its edges are sloped at a tangent instead of being cut at right angles. It is mainly used when the metal is of a heavy gauge.

Diag. 150.—The Scarf, or Wedge Joint.

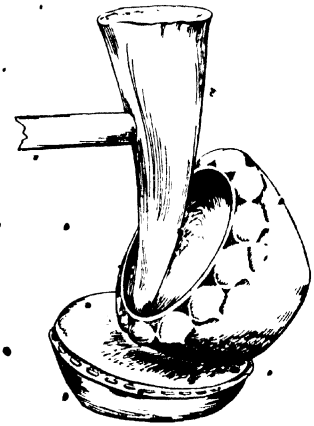
CHAPTER XIV

RAISING SHEET METAL

THE process of working sheet metal into hollow vessels of varied shape and size demands complete mastery in the use of the wooden doming mallet, and V-shaped horn tip (Diags. 28 and 151).

Wonderful and exclusive shapes are possible in metal with this process when in the hands of a competent craftsman.

With care, regular annealing, and skilful manipulation of the mallet and hammer, the metal can be modelled and stretched from size 22, B.W.G., at the base of the vessel, to size 18 at the rim, while similar results are obtainable with the precious metals.



Diag. 151.—Application of the Horn Tip.

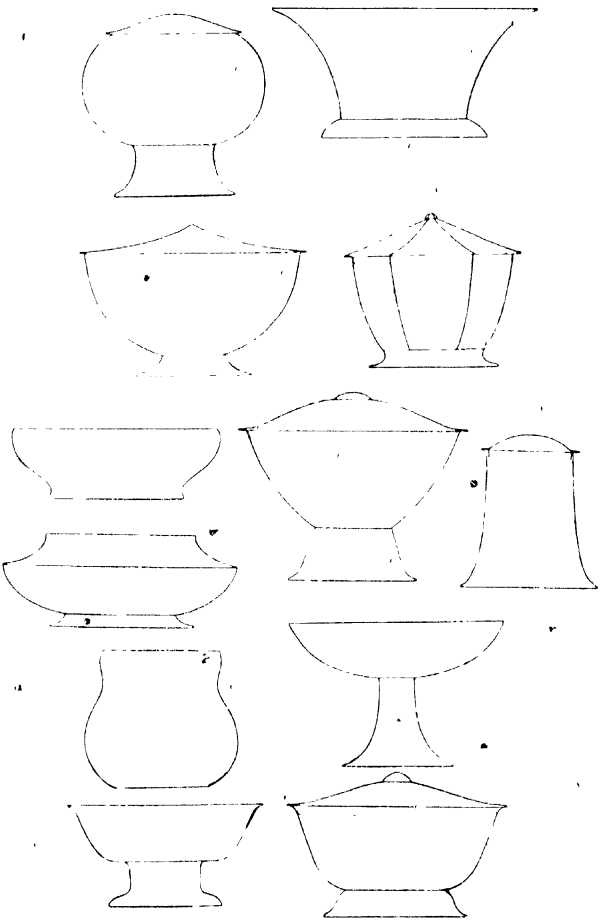
Communion plate, bowls, and cups are commonly treated in this fashion to provide weight and strength at the rim, also to obviate the application of a mounted wire. Diag. 152 will convey varying forms evolved from the circle exclusively. The possibilities offered by this process for work in enamel are invaluable, owing to the entire absence of a seam or solder.

The Tools required for this work are the doming mallet (Diag. 28), the V-shaped wooden mallet, or the horn tip (Diags. 151 and 153).

A solid leather sand-pad, or a tree-block about 2 feet in height with hollows of varied shape and depth cut on its surface, will prove a valuable accessory (Diag. 154).

Cow's tongue stakes are the best surfaces for raising hollow shapes (Diags. 155 A and B). On these tools small hollows, large bowls, or cups

may be wrought with equal facility, *while they may be utilised in various ways for different shapes*, if secured in the vice at varying angles.



Diag. 152.—Forms wrought from Flat Sheet Metal

A flat, circular bottom stake will prove a useful tool in levelling the sole of a hollow vessel, or, as a substitute, a flattened poker-head may be used (Diag. 156).

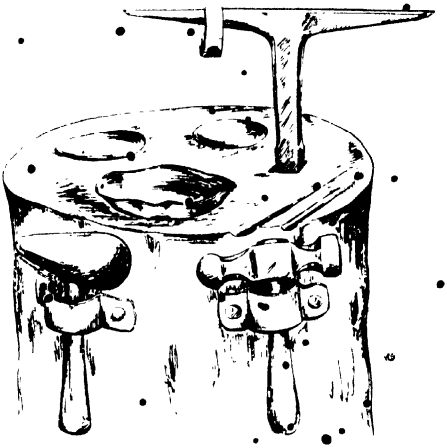
A horse (Diag. 157) with several small heads, A, B, C, and D, will be found of great service, especially in the final planishing of the work with the steel hammer. Several hammers (steel) of the shapes suggested in Diags. 29 and 158, will be necessary to complete the stock of raising tools.

Diag. 153.—Drawing up with the V-shaped mallet.

The Metal Gauge.—In drawing up small objects use size 22, B.W.G., brass or copper, and for similar work in gold or silver, sizes 7 or 8, metal gauge.

Larger vessels will demand greater strength, therefore use size 20, B.W.G., in the baser metal, and sizes 9 or 10 metal gauge for the precious metals.

The uniform thickness of the metal is entirely in accordance with its treatment while under the hammer of the craftsman. This ability can only be attained after long and patient practice. In cutting the metal for the raising of a bowl, cup, or similar form, the approximate size may be realised by keeping the circle of metal a shade less than the combined diameter and depth of the vessel. If a thick metal is used (as in the beating of a bowl from a medal), naturally a smaller surface will be required than if wrought on a thin medium. Use a steel hammer for this purpose.

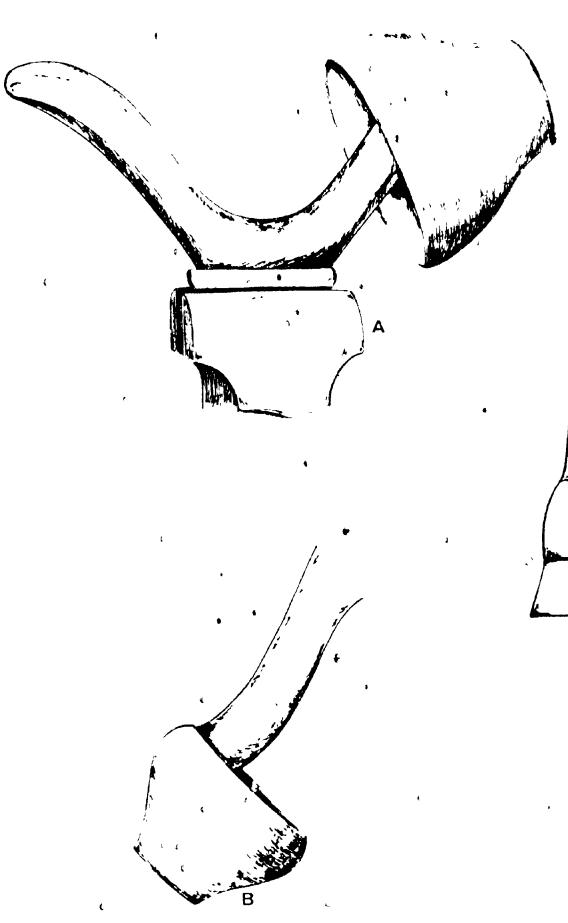


Diag. 154.—The Tree Block.

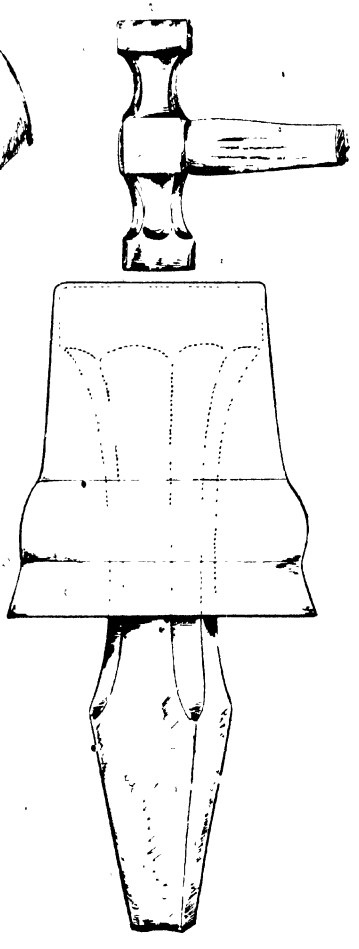
The Process.—Cut the desired circle with care and accuracy, improving any irregularities of line with the file before commencing the working of the metal.

From the centre of the circle draw lightly with the steel dividers two or three concentric lines, allowing the inner circle a diameter of 2½ to 3 inches (Diag. 159).

With the metal disc resting loosely on the sand-pad (Diag. 160), or the tree block (Diag. 49), deliver uniform heavy blows with the wooden



Diag. 155. Applying the Cow's Tongue Stake.



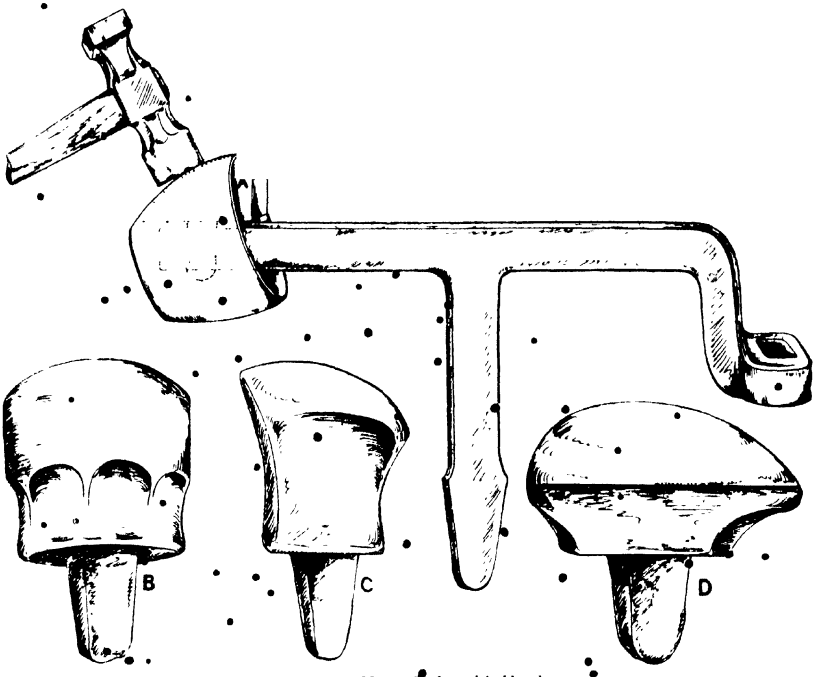
Diag. 156. Bottom Stake.

doming mallet (as illustrated), commencing at the inner circle and working in circles outwards till within 1 inch of the outer edge. The

disc will now have assumed a form similar to Diag. 161, irregular at the edges, with signs of buckling, also tight and springy.

Annealing must now be resorted to, afterwards quenching the metal in the sulphuric pickle if silver or copper, but allowing gold, brass, or similar mediums to cool slowly.

Any parts of the edge, if puckered, may be brought to a level by resting it flatly on the bench and tapping them out with the flat

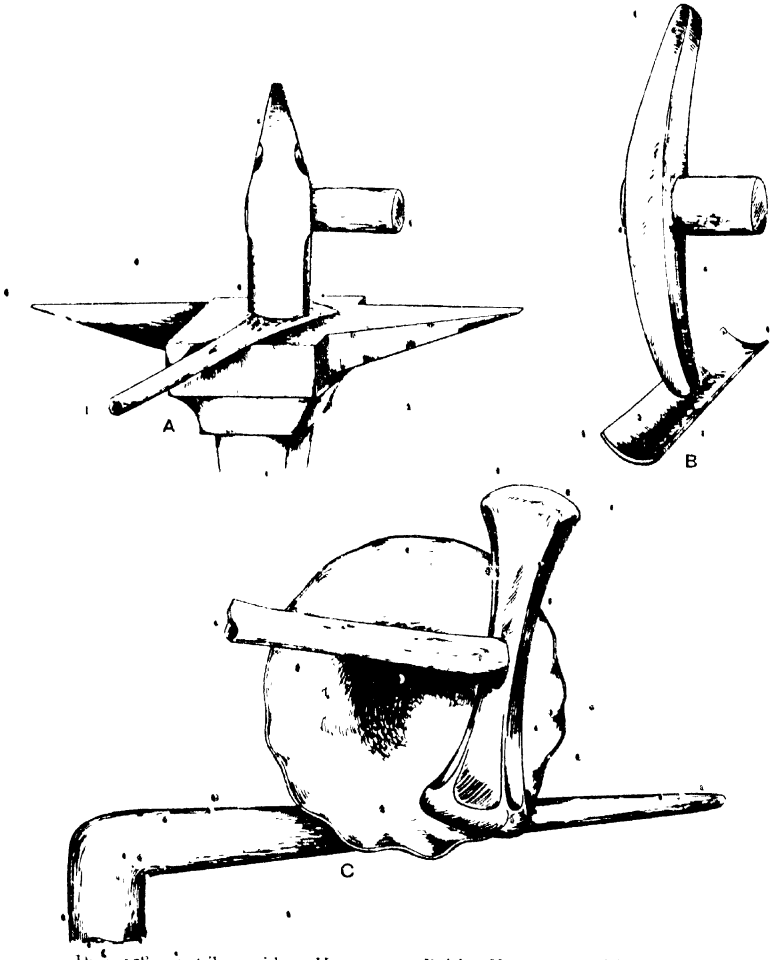


Diag. 157.—Horse Stake with Heads

end of the wooden mallet (Diag. 162). Continue the above process until a uniform saucer-shape is evolved.

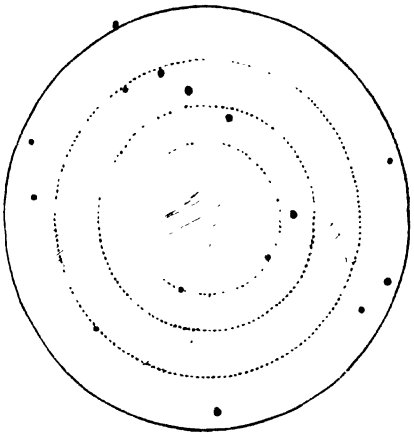
Never beat down the inner circle; this precaution will ensure sufficient strength to carry the foot, or shaft, if it be intended for a cup or similar object. The work, after annealing and attaining the shape in Diag. 163, will be wrought on the cow's tongue stake with the V-shaped wooden mallet, or horn tip. The circles as guiding lines will now be drawn

on the *outside* of the work, and the concentric hammering continued, with annealing at regular intervals, until the desired shape is attained.



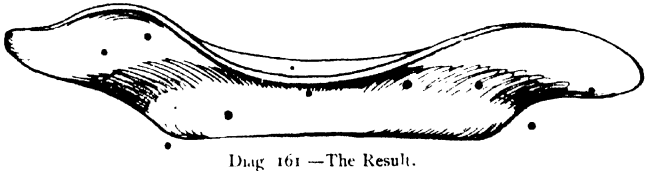
Diag. 158.—A, Silversmithing Hammer; B, Raising Hammer; C, Collet Hammer.

As the vessel develops in shape the calipers (Diag. 164) must be introduced to ensure uniform lines, and a truly hammered vessel. Excellent

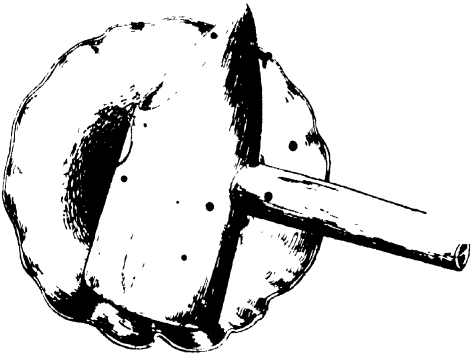


Diag 159 —Guiding Lines.

Diag 160 Doming on the Sand Pad.



Diag 161 —The Result.



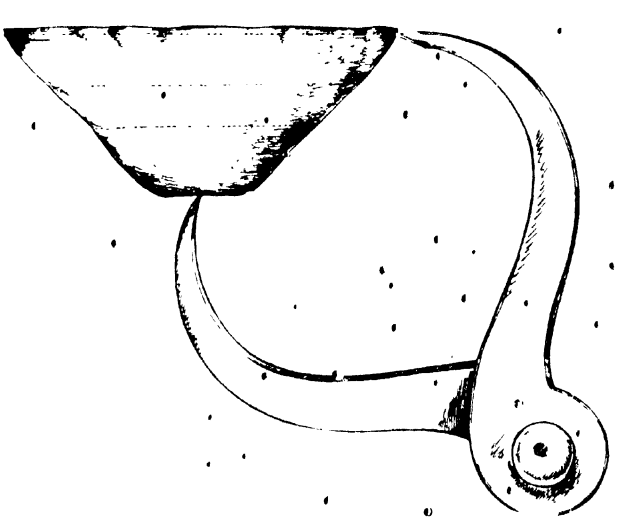
Diag 162 —Tapping out the "Kinks."

Diag. 163.—Form previous to drawing up.

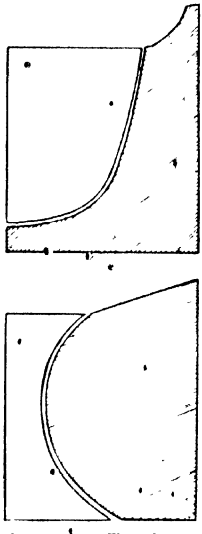
practice will be afforded if the student works to a fixed shape and size, the necessary accuracy imposed by this method proving a valuable training.

Templates in cardboard or zinc may be introduced in testing the accuracy of the various shapes attempted (Diag. 165).

The mouth of a hollow vessel may be brought to a perfect level if, after drawing the marginal line with the calipers, and cutting the surplus metal with the bent shears, it is ground with a rotating action on a flat sandstone.



Diag. 164.—Testing the Edge.



Diag. 165.—Templates.

Exclusive Shapes or decorated forms, with large bold circles, ovals, or fluted sections (Diag. 166), may be easily wrought from the inside of the vessel. The object, if large, may be secured on a bed of warm pitch; or excellent results are possible on a thick surface of modelling clay. In this process work mainly with wooden or horn tools, and anneal the work at regular intervals.

Good results and unique shapes are more easily attained by the manipulation of tools and material only.

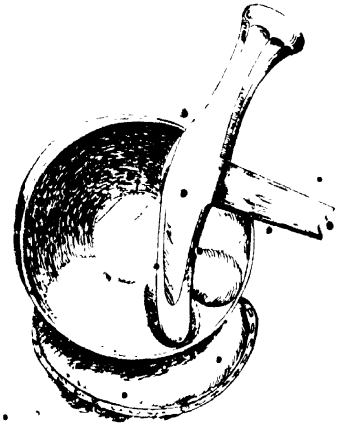
Planishing.—Diag. 167 constitutes the final surface finish of the metal with the steel hammer, after the required form has been fully realised with wood or horn implements.

Its application will result in a delightful hammered texture, combined with additional hardening and strengthening of the otherwise soft metal.

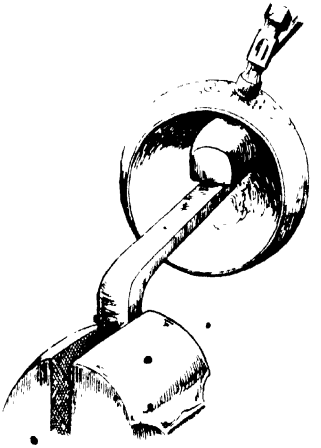
In planishing, have the metal and tools perfectly free from grit, also rest the work on the most suitable stake to ensure solidity.

The application of the hammer will require a stiffening of the arm at the wrist, and a perfectly level blow, otherwise objectionable blemishes from the edge of the hammer will result.

To the young student this process is occasionally disheartening; however, if first attempts are applied on a small piece of scrap copper, this apparent difficulty will be much simplified



Diag. 166.—Embossing.



Diag. 167.—Planishing.

Concise Rules. Execute the raising process entirely with the wood or horn tools, and reserve the steel hammer for the final planishing, unless in elaborate shapes, or fine mouldings, when the heavier tool may be necessary.

In sinking a hollow vessel avoid overdoing the process, the metal is more apt to be weakened by blocking down than with drawing up on a stake.

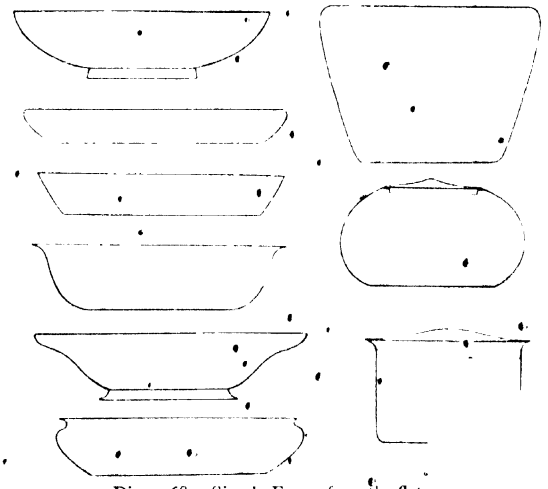
Diag. 168 will provide several shapes on simple lines specially adapted for the young student.

Lathe Work, although mainly applied to the spinning of light and cheap commercial ware, is a process worthy of the craftsman's attention. By its agency circular vessels may be turned or trued up on a wooden

block secured to the face plate, or various wires and mouldings may be executed.

Circular castings of feet, terminals, buttons, shafts for keys, or similar work can be readily cleaned by its application.

Knurls of various designs may also be applied to the metal while the



Diag. 168.—Simple Forms from the flat.

object revolves on the lathe, while for drilling or buffing it is a useful agency.

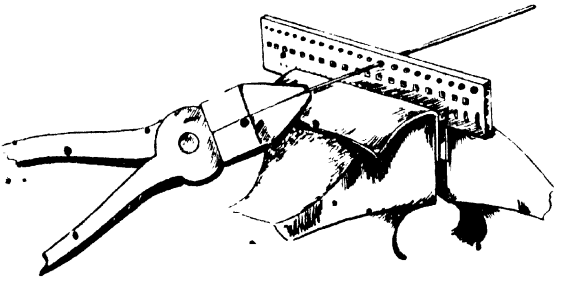
Bruises or other Defects occurring on a vessel, where its form will not admit application from the interior, may have the bruise removed by soft-soldering a loop-shaped strap of metal immediately over the blemish. The vessel must now be held firmly, and the depression steadily drawn forward by a careful pulling of the metal strap.

CHAPTER XV

WIRES AND WIRE-DRAWING

Drawn Wire and its adaptation decoratively presents a wide field for study, with a wealth of ideas. From the round, half-round, square, or triangular form unlimited combinations may be evolved by the thoughtful student, while various metals may be interlaced for the attainment of unique effects.

From the crude ingot the metal may be forged with the hammer, and by gradual drawing and regular annealing it can be reduced to a filigree.

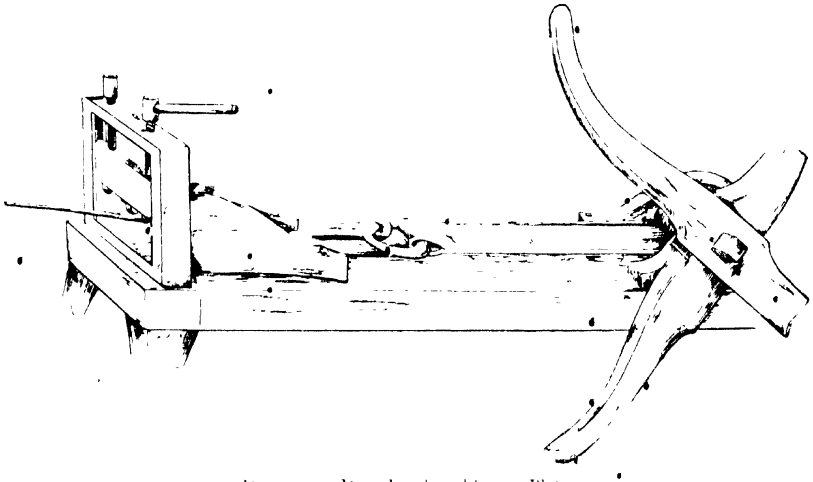


Diag. 169.—The drawing of Wire.

The Necessary Tools for this process are the draw-plates, draw-tongs, or strong pliers; through their application light wire, from $\frac{1}{8}$ of an inch, may be successfully drawn (Diag. 169). Larger and more ambitious work will demand the use of the draw-bench, rolling-mill, lathe, and swage-plate. Their uses, however, to the individual worker will only be occasional, when a specially heavy wire or exceptional form is required.

The steel draw-plates have various graded holes of several shapes. Two draw-plates will be necessary, one of moderate size, and the other for filigree wire. An additional plate of square, half-round, and triangular sections would prove an acquisition. The rollers are useful in the flattening of round wire before twisting, or in preparing it for other decoration.

A silversmithing hammer (Diag. 158 A) can be used for this purpose, but in its application care must be exercised to avoid irregularities The lathe is mainly employed in turning down solid wires on vessels

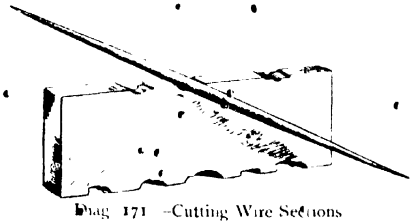


Diag. 170.—Draw-bench and Swage Plate.

of gold or silver; gravers, scrapers, and other turning implements being required in this process.

The draw-bench and swage (Diag. 170) may be wrought in conjunction with one another.

New wires and mouldings may be cut on the swage-plates with files of various sizes (Diag. 171). Being of mild steel, they are very adaptable.



Diag. 171.—Cutting Wire Sections

Diag. 172 will convey the many possibilities for decoration on wire with a simple plain section; chasing tools may be employed in all manner of ways to give enrichment to the metal. Beaded wires may be produced from dies (see Chapter XVII).

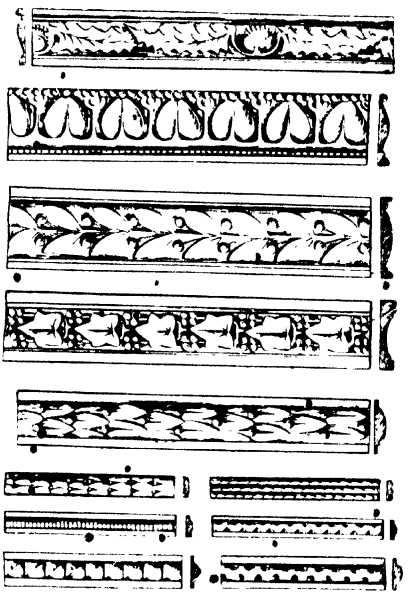
The Process.—After forging the ingot of wire to a fairly uniform thickness of a ¼ of an inch, the point must be smartly tapered with a rough file (to provide a grip) and "threaded" into the most suitable hole

(Diag. 173). A slight application of tallow will ease the pulling, while at regular intervals the wire must be annealed.

If a heavy wire, the tapering point may be forged while hot (not red-hot, or it will be liable to break). Quench silver or copper immediately after annealing.

Arrange the wire in a coil (as in Diag. 53) during annealing, and play the flame lightly. Filigree wire must be of pure silver or it will be liable to snap in the draw-plate.

Fine tubular wire, or "chenier," may be formed in the draw-plate, or doming block (Diag. 174 A and B). First model the tube in sheet metal as described in "wiring" (Chapter XI.), keeping the breadth of metal three times the diameter required. File or cut one end obliquely as in Diag. 175, and insert a "threading" point of solid wire, previous to pulling it through the draw-plate.



Diag. 172.—Wire (Various Forms).

A few applications of this process will perfect the tube. If used as a hinge, carefully fit the separate parts of the tube before soldering them to the object.

Diag. 173.—"Threading" the Wire.

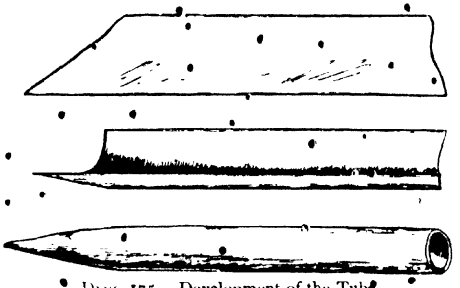
Hollow Tubes may be curved by filling the cavity with soft lead or warm pitch, also by packing tightly with sand, afterwards bending them over a wooden mandril

An application of whiting paste (well dried) before inserting the lead, etc., will ensure a clean surface when the medium is melted out.

Diag. 174.—Chenier.

Solid or Tubular Wire may be hardened and strengthened by resting the metal on an anvil and applying light, rapid hammer blows.

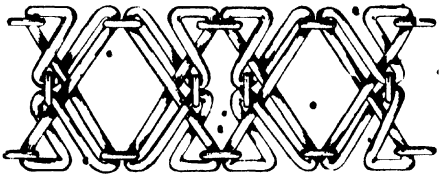
Chainmaking is practically the result of winding the metal, in wire form, over mandrils of various shapes. This branch of the craft provides



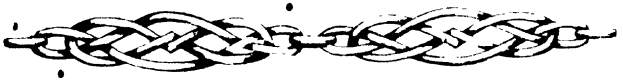
Diag. 175.—Development of the Tube.

many opportunities to the craftsman, hand-wrought chains being a decided exception.

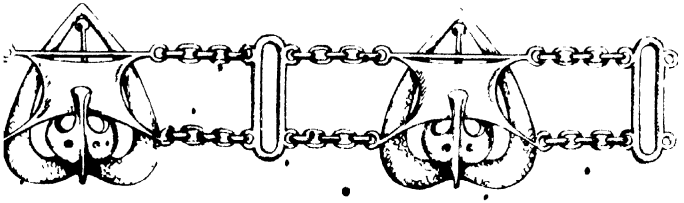
The following diagrams present several diverse treatments of wire in relation to chainmaking.



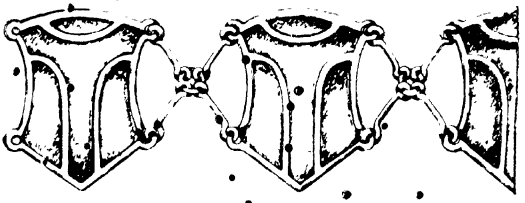
Diag. 176A.—Chain executed from Drawn Wire



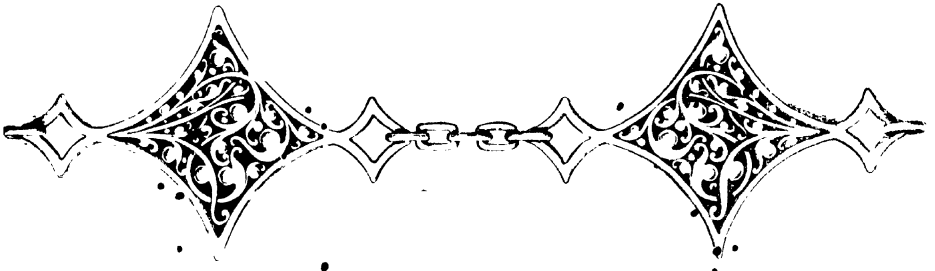
Diag. 176E.—Chain adapted from Drawn and Plaited Wire



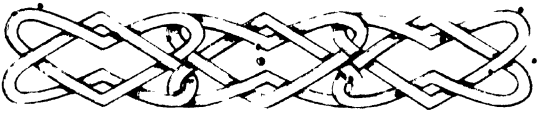
Diag. 176C.—Chain with Cast and Drawn Links



Diag. 176D.—Chain with Die-Struck and Drawn Links



Diag. 176A.—Chased and Engraved Links combined with Drawn Wire



Diag. 176F.—Chain produced from Pierced Links

How to make a Draw-Plate.—The student, if desirous, may make a draw-plate from a medium-sized flat file.

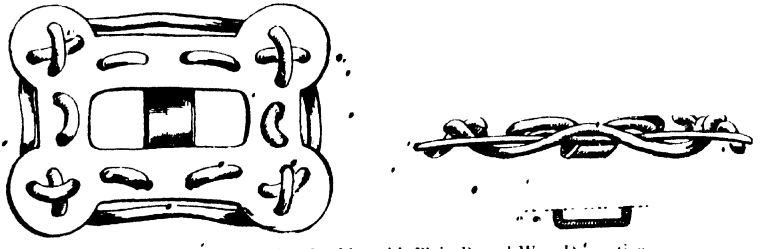
Reduce the temper by annealing and gradual cooling, afterwards file or grind it to a smooth surface.

The position of the holes may now be spaced off at fixed intervals with a centre punch, and numbered in rotation with a small tracer.

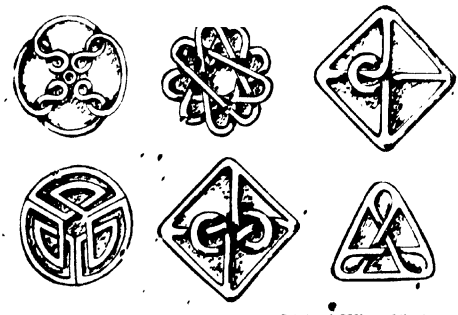
The holes of graded size may now be drilled, and slightly countersunk at one side to admit the wire.

If difficulty is experienced with the drilling through the want of an efficient lathe, or upright drill, any jobbing smith will execute this work. If several square, oval, half-round, and triangular holes are pierced, quite a serviceable draw-plate will be acquired.

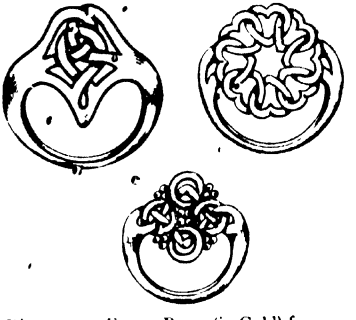
Various Adaptations of Plain and Decorated Wire.



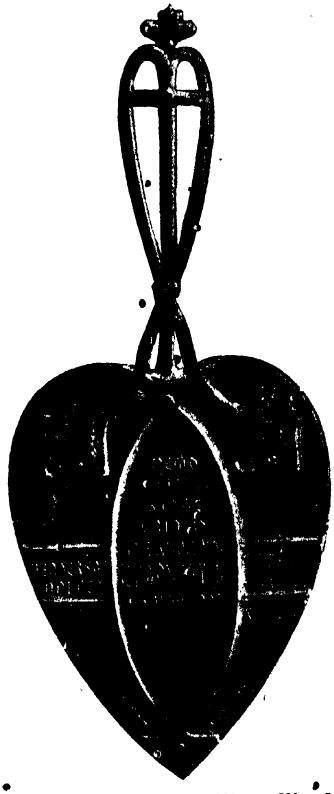
Diag. 177.—Silver Shoe Buckles with Plain Round Wire Decoration.



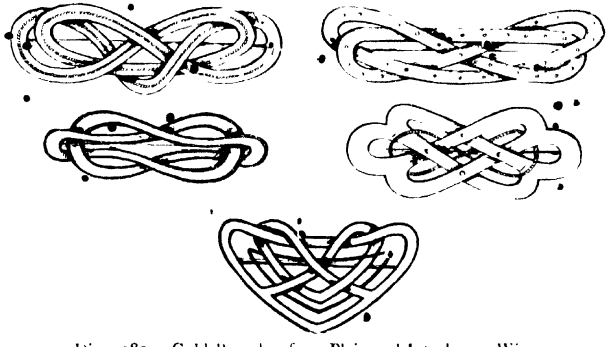
Diag. 178.—Silver Buttons with Plaited Wire (Flat).



Diag. 179.—Finger Rings (in Gold) from Interlocking Plain Circular Links.



Diag. 180.—Silver Trowel with Woven Wire Handle



Diag. 181.—Gold Brooches from Plain and Interlacing Wires.

CHAPTER XVI

CHASING IN GOLD AND SILVER

Chasing is the finest embellishment possible upon a metallic surface with a hammer and chisel.

It is mainly applied to gold and silver cups, bowls, shields and trophies, or in the production of innumerable small details in jewellery.

To Excel, practise assiduously at various types of work in bold and bas-relief, and on various metals.

By this method only can that instinctive touch be attained which stamps the master hand.

For choice, heraldic work presents the best practice, by reason of its wide scope, and strong, decorative features.

Lettering of various kinds is valuable, as requiring accuracy and confidence in the exercise of the punches.

The Punches required are similar to the repoussé tools, although smaller in surface and more numerous. Their cutting edges are also considerably sharper to ensure cleaner outlining. Chapter VIII. (Diag. 60) will provide a better realisation of these tools.

Other Requisites.—The chaser's iron pitch bowl, with wooden triangle, or leather collar, Chapter III., Diag. 23, is an indispensable agent in the work, while the repoussé or chaser's hammer may be classed of equal importance. Fairly hard pitch must be used to provide the necessary resistance required in the finer tooling.

A small piece of chaser's wax will prove useful in ascertaining with a "squeeze" the relative heights and general effects of the parts in relief from the obverse side, while the work is in progress (Diag. 192, Chapter XVII.).

The Wax may be prepared from the recipe and directions in Chapter XX. (carefully noting the difference between the modelling and casting wax).

Several snarling irons, for embossing figures or similar ornamentation on a hollow vessel, are necessary (Diag. 71).

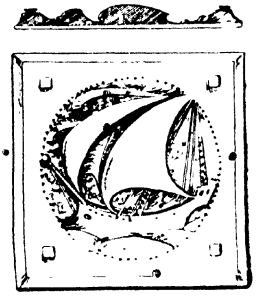
The Process is akin to working in repoussé, only on a smaller and much finer scale, the methods of holding the hammer and punch being exactly alike (see Diags. 4 and 5).

Standard silver will respond freely to the manipulation of the tool: being like copper in character, it may be worked similarly. Pure silver in capable hands may be wrought as willed, its ductility being adaptable for fine detail, and undercut parts in bold relief (Diag. 182).

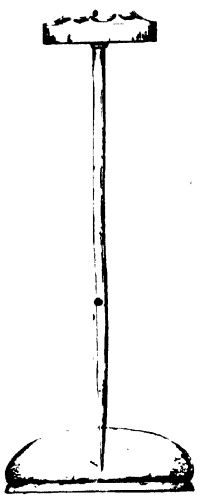
Chasing in Gold, and especially 15-carat and under, is beset with greater difficulties than in any other medium, owing to its liability to crack if improperly wrought.

To minimise this danger, scrupulously avoid cutting the surface "skin" of the metal with the tool. Fix the outline of the design by merely indenting it with a small, blunt, hollow punch or dot, as illustrated in Diag. 183. Reference to Chapter V. will refresh the mind on this process.

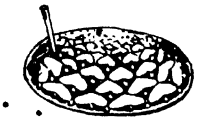
The "dotted" impression will be easily followed on the obverse side, and will serve as an efficient guide during the work of embossing.



Diag. 182.—Undercutting.



Diag. 183.—Stitching.



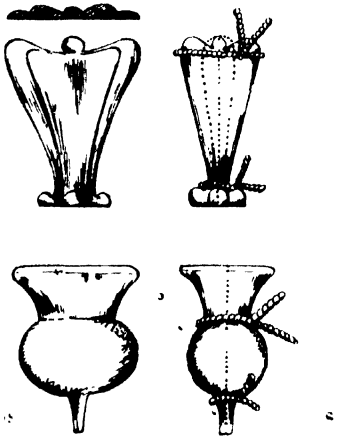
Diag. 184.—Plugging.

Never permit the gold to become hard or springy, but anneal it regularly after each fresh application of the punches. If cracks occur in chasing, use gold solder. Small holes or open cracks will require "plugging" with a thin wedge of plate, or gold wire (Diag. 184), afterwards soldering. Keep the pitch during work slightly warm, especially if modelling the metal, but perfectly cold if incising fine lines or tooling delicate detail.

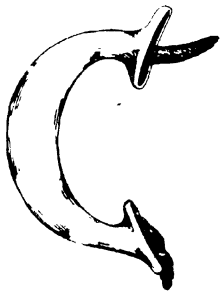
In chasing, particularly avoid all matted grounds, hair upon animals, feathers upon birds, etc. These are foreign to the decoration of a metallic surface, and are merely the outcome of misdirected craftsmanship.

Perloirs, hair-mats, running mats, and freezers are tools which the

student may rightly avoid. Their uses artistically are limited; they are only of real service in the retouching of castings, Chapter XX.

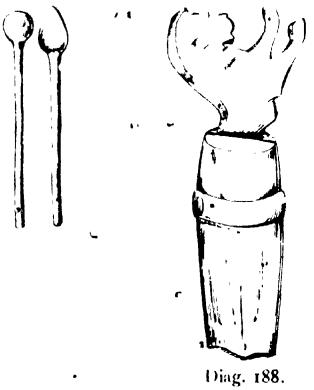


Diag. 185



Diag. 186.

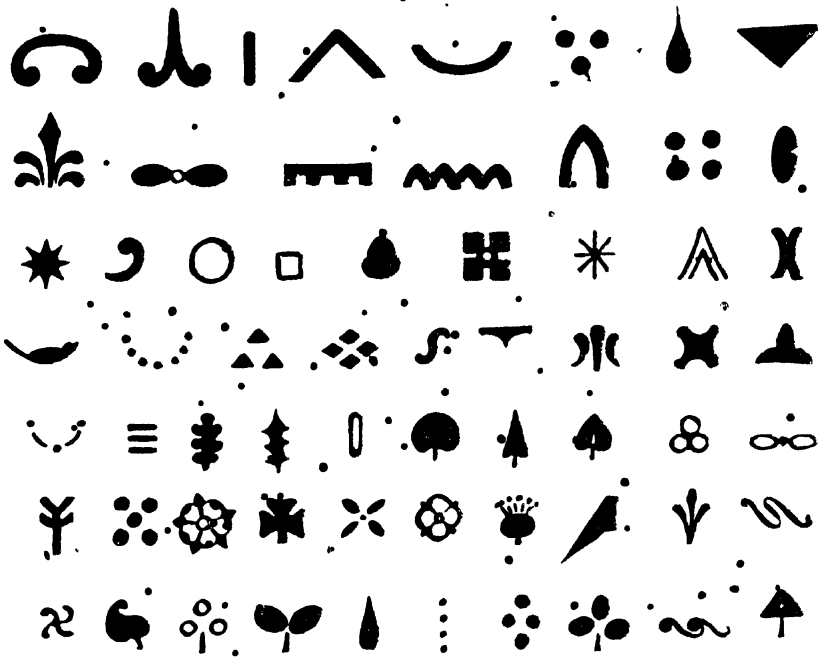
Diag. 187



Diag. 188.

In applying the tools to gold or silver, aim at attaining the desired effect in a direct and masterly manner, otherwise the chasing will

assume a hard and laboured effect. Small chasings, when completed, may be released from the surrounding metal by incising a deep and clearly cut outline with a fine sharp tracer, while the work is perfectly cold. Then trace this outline with an equally fine cutting chisel, hammering quickly, and guiding the punch slowly throughout the work. The piercing-saw may also be used in place of the chisel, but its use in certain



Diag. 189.—Tool Impressions.

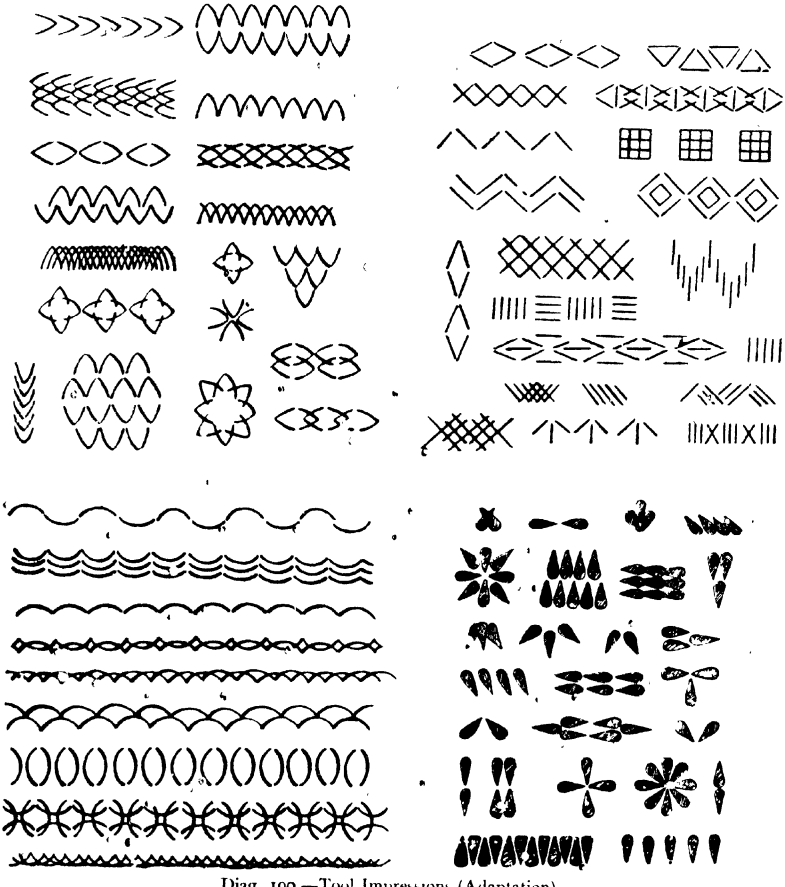
work would weaken the metal edge, and detract from the height of the object.

Chasing, its Adaptation.—As a decorative branch of the craft its uses are indispensable, small figures, flowers, and leaves being produced with ready facility.

Figures or similar objects may be chased in halves; then cut them out carefully, file level, and mitre them together with iron binding wire before soldering (Diag. 185).

Observe, a small vent or air hole must be left in all hollow work The

work, after soldering, may require retouching with the punches, which will necessitate the filling of the object with pitch in the form of narrow rolls (Diag. 186).



Diag. 190.—Tool Impressions (Adaptation).

To preserve the original crispness in fine chasing, omit when possible the annealing process, as the softening action of the fire slightly deadens the texture and quality of surface.

Carving in the solid metal will serve as valuable practice in the use

of the graver and cutting chisel, combined with the piercing saw. Diag. 187 is sawn, carved, and chased direct from a piece of solid wire.

The bulk of metal required may be obtained by melting it in a crucible or hollow of a charcoal block, and forging to size with a hammer. The outline of the lion (side elevation), A, may now be drawn on the metal, and cut with the fretsaw (on the rough), B.

Now grease the object well, and fix it on the pitch bowl, when it may be chased, and carved until it attains the correct proportions, C. Now remove it from the pitch and clean by annealing. The wooden clamps (Diag. 188) will retain it in position, without injuring its surface while the fretsaw and file separate the limbs. Avoid over-doing the tooling, aim mainly at strong effective touches.

This process will facilitate the use of enamel on an entire figure, whereas similar work if cast would not prove so reliable.

The above process may be simplified if the first model is cut from thick lead as a preliminary exercise.

The small model thus acquired may serve on a future occasion as a matrix in casting (Chapter XX.).

Incised Tooling.—Diag. 189 represents a simple yet effective style of decoration. It can be clearly studied from the old pewter in our museums. In addition to heraldic devices, these "blind" tooling effects provide excellent samplers of the creation of pattern and design from tools and material only. Diag. 190 will convey their application in flat decoration

CHAPTER XVII

SIMPLE DIE-CUTTING

Die-Cutting.—While undesirous of fostering the mechanical regularity of commercial work, there exists here a quality of surface and beauty of line ever worth striving after.

Excellent examples of this treatment may be studied from the old coinage in our museums, which present typical features of soft, undulating surfaces, decorative lettering, and pleasing outline, all in marked contrast to many of the modern productions.

The Various Metals.—Dies or small punches (for blind tooling) may be cut in mild steel with drill, cutting chisel, and graver. They may also be cast in bronze or iron to meet the requirements of certain styles of work.

Cast-iron and bronze dies are easily and cheaply produced, although their durability is limited compared with a die of cut steel (Diag. 191).

The Process.—The making of small punches (Diag. 191A) suitable for impressions as in "blind tooling" decoration will afford a perfect introduction to the more difficult process of die-cutting.

The surface of these tools may vary from a ¼ inch to a ½ inch square.

As in punch-making, anneal the steel before commencing the work.

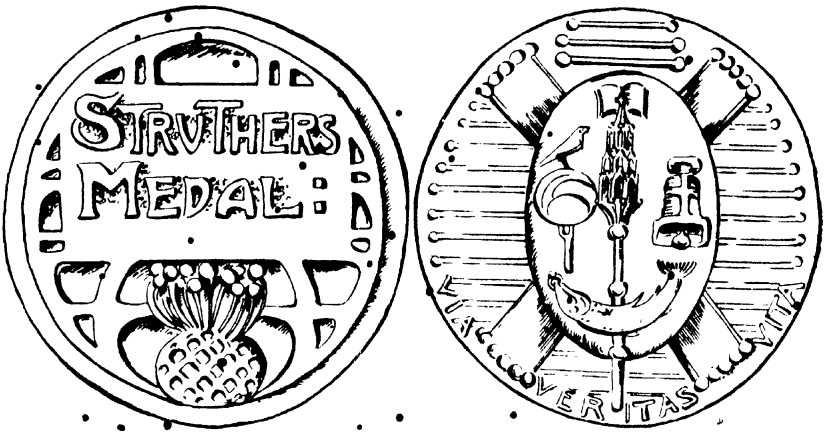
The outlines may now be deeply incised on the previously levelled surface, and the ground gradually sunk to the required level with the graver, drill, and chisel.

Squeezes in wax (Diag. 192) may be taken as the work proceeds, also stampings can be tried on soft sheet lead. The tool face, in finishing, may receive a first application with water-of-Ayr stone, and a final polish with emery.

The tempering of the punch will be executed as directed in Chapter VIII. Avoid making it too hard.

The Steel Die may be proceeded with on similar lines as the punch, only on a much larger scale. The services of a lathe and a good upright drill will be helpful in cleaning out the deeper parts of the die.

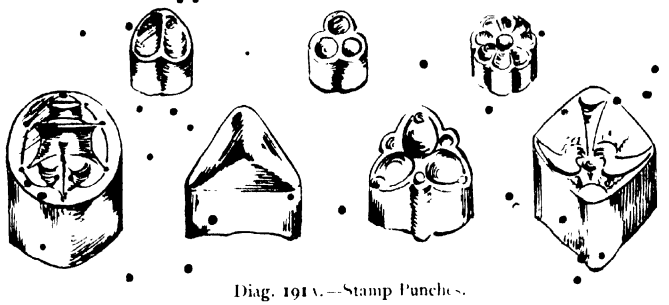
Use a block of mild steel, in size from 1½ to 2 inches by 1¼ inch, with a slight taper as illustrated (Diag. 193).



Diag. 191.—The "Struthers" Medal, in Gold
Designed by Ann Macbeth

The "spread" at the base will provide greater strength in the "striking."

A matrix of the work, modelled in plasticene or clay, with a corresponding cast in plaster from its surface, will provide an excellent guide



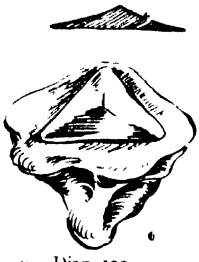
Diag. 191A.—Stamp Punches.

to the various heights and depressions of the decoration. Transfer the outlines of the design to the steel with a "stitched" line, afterwards incising it deeply at the necessary points.

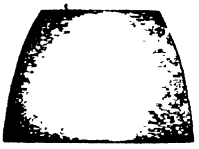
Trench the main depressions with a suitable drill or die-sinker's burr (obtainable in various sizes and shapes). With the general details paved

out, employ the hammer and cutting chisel in modelling and smoothing off the remainder of the work.

Use the chaser's wax as previously directed, and compare the different surfaces as the work proceeds with the original model in plasticene or clay.



Diag. 192.

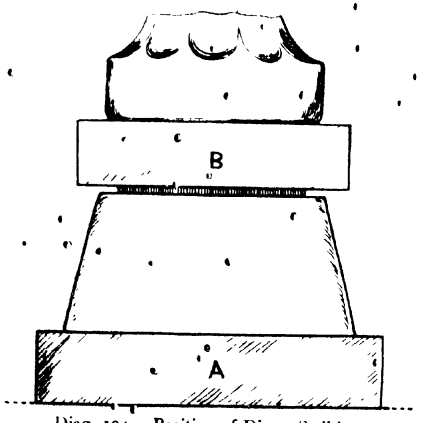


Diag 193

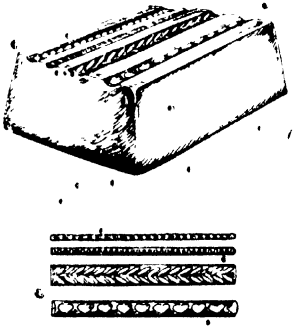
Fine lettering or similar enrichment may be incised with the graver and a sharp outliner. Smooth and finish the various surfaces with emery, pumice, and water-of-Ayr stone.

This final process must be cautiously applied, otherwise the charm of the "tooling" may be irreparably lost through excessive finishing.

Before tempering the die, an impression in soft lead may be taken, as in punch-making, to test form and height.



Diag. 194.—Position of Die in Striking.



Diag. 195.

In directing the blow from the heavy hammer, rest the die on a solid block of lead, A, while a similar block, B, is placed above the metal to receive the blow (Diag. 194).

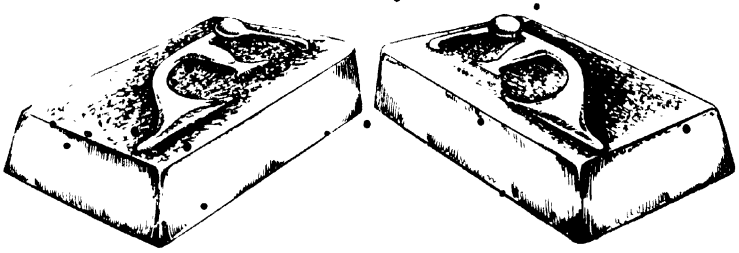
Small steel dies of this type will be useful in the production of beaded or similar fancy wires.

If an inch or more of the desired pattern is sunk on the face of the die, the plain wire may be moved along to receive the impression with each hammer blow (Diag. 195).

The Cast Die for certain types of work is a most convenient agent.

A matrix, Chapter XX., is modelled in wax or clay to the required design. A hollow mould in plaster-of-Paris is taken off its surface, and built to the form of a die with additional plaster. When thoroughly dried in the oven, give the die pattern a thin coating of shellac varnish, which will supply a hard and smooth surface for the sand mould. It will now be ready for reproducing in cast-iron.

Diag. 196 illustrates the cast-iron die with two halves of a small handle. The sheet metal is wrought into shape over the face of the



Diag. 196.—Cast-iron Dies.

die with the wooden mallet and horn tip punches, annealing regularly as the metal hardens. A cast in lead is now taken from the die (Diag. 197).

A thick collar of damp (not wet) modelling clay will serve as a wall in retaining the molten metal.

Concave dies of various shapes and sizes, adaptable for "striking" salts, bowls of spoons, ink-pots, etc., may easily be obtained by the above process.

The final blow is applied with a heavy hammer with the lead mould resting on the die, and the unfinished handle in between, which will result in the metal being drawn keenly to the shape of the handles on the die.

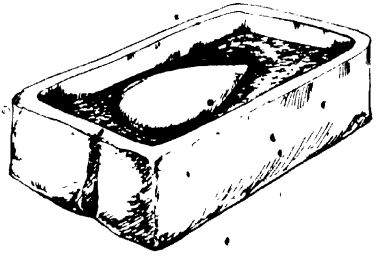
The lead mould may now be removed, and the "struck" handle released. After careful cutting out with the chisel, the two halves may be filed and fitted preparatory to soldering together (Diag. 198).

The handle, after repairing of surplus solder, will be filled with roll pitch, and all irregularities chased and finished with punches.

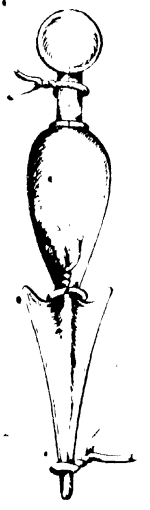
Large Flat Mouldings may be produced by cutting a template in sheet

metal and paring its shape on soft plaster. The mould may now be built and further strengthened with plaster: after this process send it to the foundry for a repeat in cast-iron.

A concave mould will prove the most adaptable, and admits rods of



Diag. 197.



Diag. 198

wood or lead to be rested on the metal and driven in with the hammer to the recesses of the die.

For special shapes demanding a limited production, wooden blocks may be cut to the desired mouldings, and the sheet metal wrought directly over their surface

CHAPTER XVIII

JEWELLERY

JEWELLERY, to be truly beautiful, must essentially be simple. A garish colour display of jewels and enamel, or other superfluous decoration in metal should be avoided. Flat or solid productions are also objectionable. Remember, metal is a pliable and sympathetic medium capable of great delicacy in treatment, and harmony of contour.

Each production should be an individual effort, and "repeats" are wisely discouraged.

Tools and material exclusively should dominate the early "motifs" in design. By this method will the student's creative faculties be developed, while the mastery of "technique" will lead to more ambitious results.

In practice aim at versatility, working alternately at all the various processes which constitute the craft.

The following illustrated exercises are specially arranged for the young student, and introduce many outstanding features of the work.

ILLUSTRATED EXERCISES.

Exercise 1.—Various treatments of metal edges executed with the file, punch, graver, and fret-saw (Diag. 199).

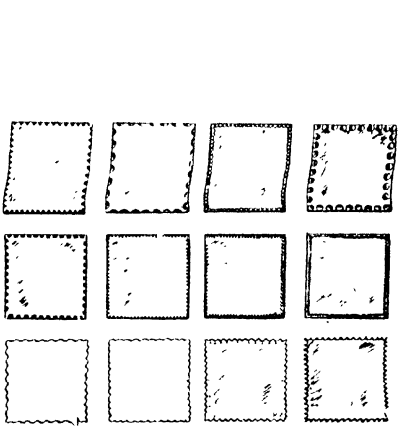
Exercise 2.—Simple forms in repoussé attained by the use of a blunt dotting-punch, small tracer, and hollow punch (Diag. 200).

Exercise 3.—Plain discs, embossed to various forms; drops and terminals from flat metal (Diag. 201).

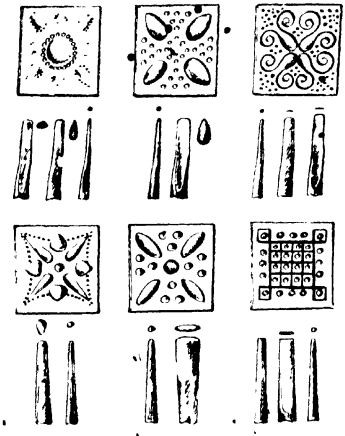
Exercise 4.—Square of metal, cut to a curve with the bent shears, centre domed, and the corners bent with the round-nosed pliers (Diag. 202).

Exercise 5.—Embossed leaf decoration, executed with blows from the pear-shaped back-grounder (small), and afterwards cut out with a piercing saw (Diag. 203).

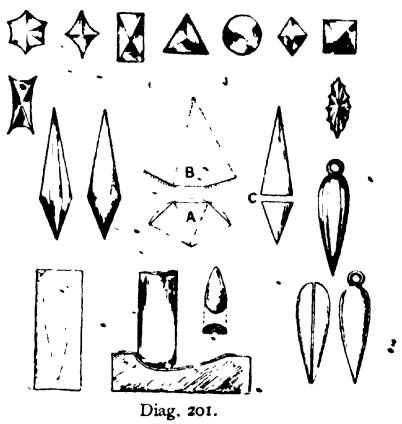
Exercise 6.—The leaf in Exercise 5 decorated with a veining of round wire (Diag. 204).



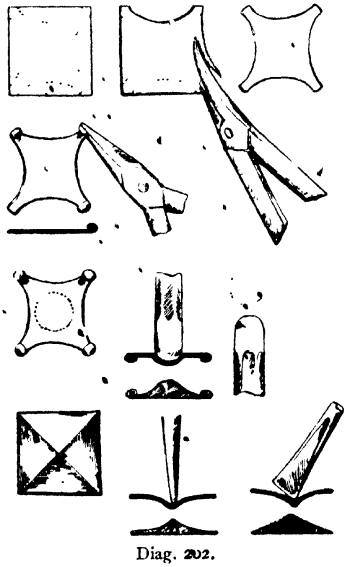
Diag. 199.



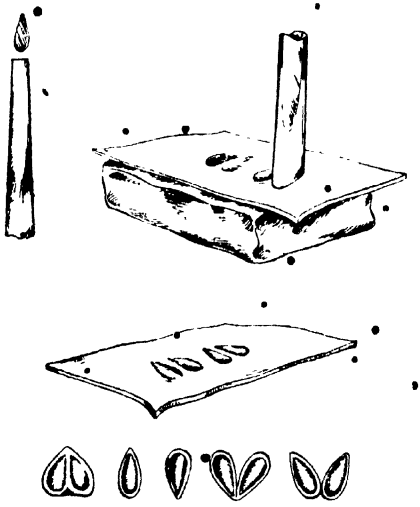
Diag. 200.



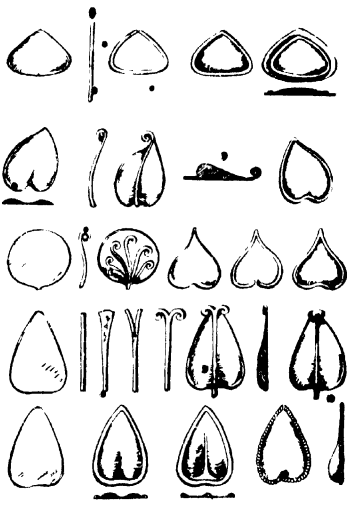
Diag. 201.



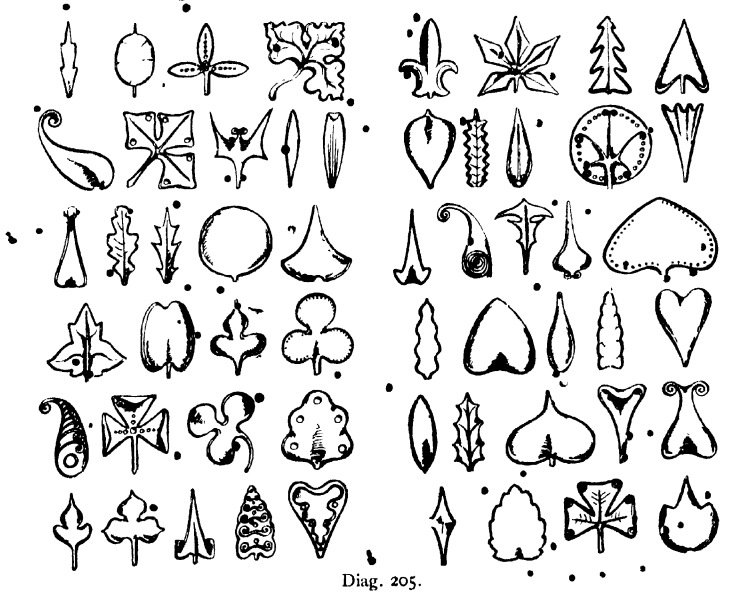
Diag. 202.



Diag. 203.



Diag. 204



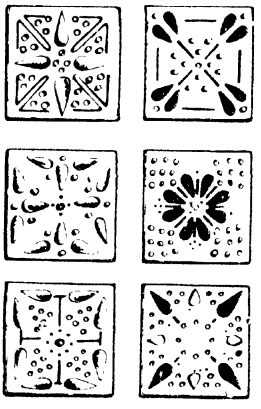
Diag. 205.

NOTE.—The above forms, in concave or convex sections, may be adapted for enamelling.

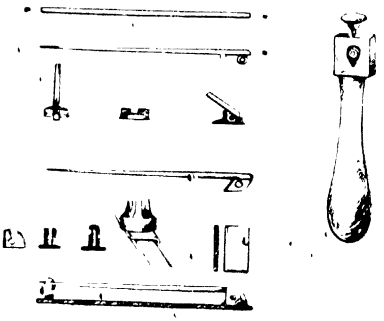
Exercise 7.—Leaves of different shapes obtained by the application of hammer, punch, and piercing-saw (Diag. 205).

Exercise 8.—Decorative effects on thin metal got by the use of the pear-shaped grounder, and small dotting-punch (Diag. 206).

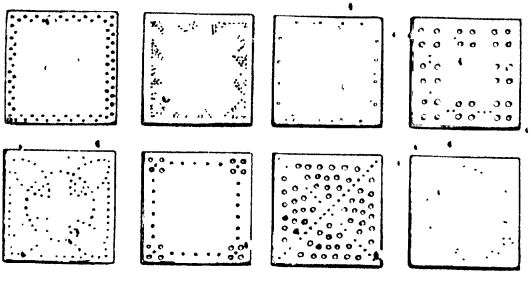
Exercise 9.—Various joints in detail (Diag. 207).



Diag. 206



Diag. 207

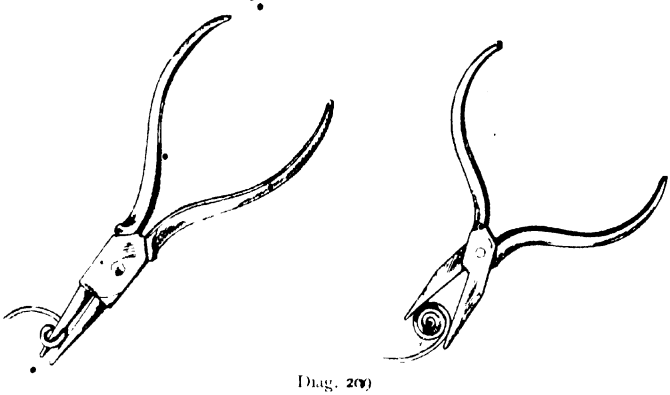


Diag. 208

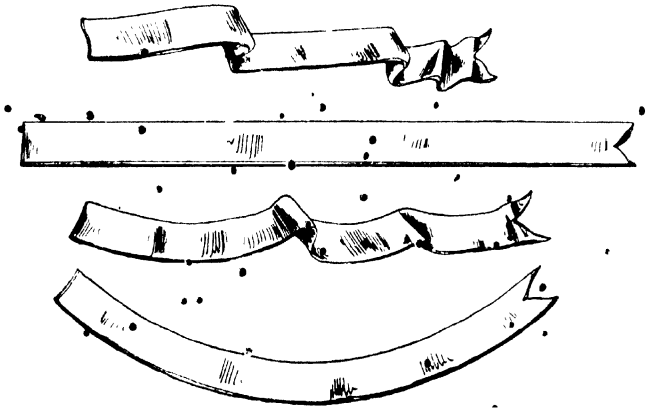
Exercise 10.—Marginal decoration of sheet metal with dots in concave and convex form (Diag. 208).

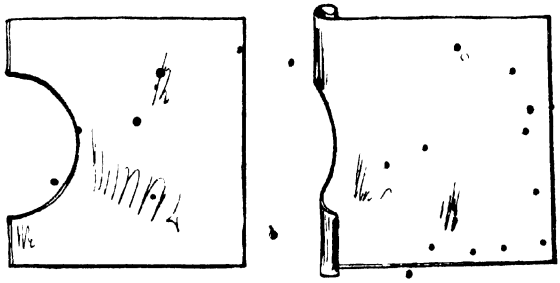
Exercise 11.—Spitals, and how to make them (Diag. 209).

Exercise 12.—Cartouches, knots, and garters, in wire and sheet metal (Diag. 210).



Diag. 209



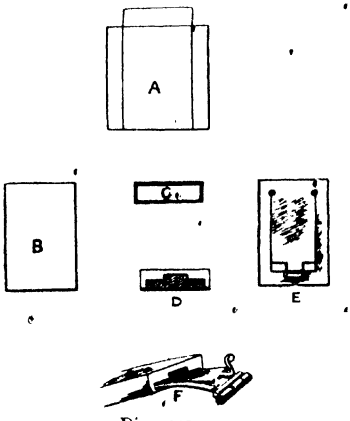


Diag. 210

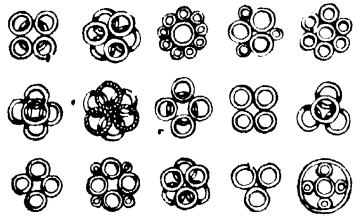
Exercise 13.—The making of a snap or shutting (Diag. 211 A, B, C, D, E, and F).

Exercise 14.—Discs, of metal, decorated with simple rings. The cavities may be filled with enamel or niello (Diag. 212).

Exercise 15.—Cuttings and rings of metal fused on a charcoal block to produce beads of various sizes. Rings of equal size if fused will

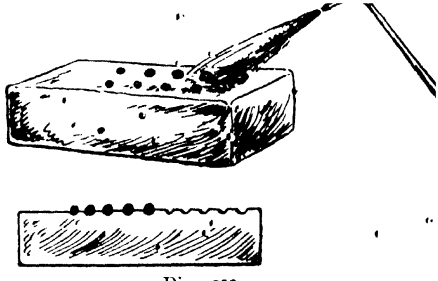


Diag. 211.

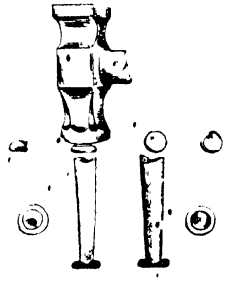


Diag. 212

Diag. 214



Diag. 213.



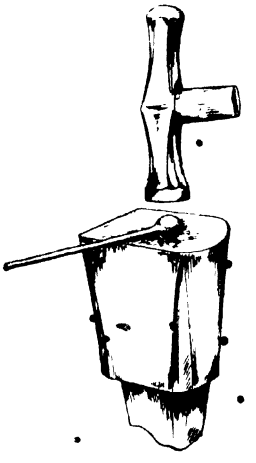
Diag. 215.

result in a uniform size of bead. Perfectly circular beads may be obtained by fusing in a smooth, round depression in the charcoal block (Diag. 213).

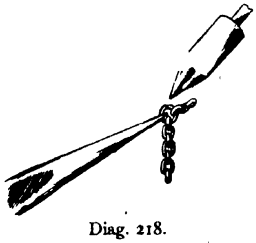
Exercise 16.—The placing of an object on the charcoal block to allow the fullest concentration of heat (Diag. 214).

Exercise 17.—The flattening of a bead with a hammer blow to a different form (Diag. 215).

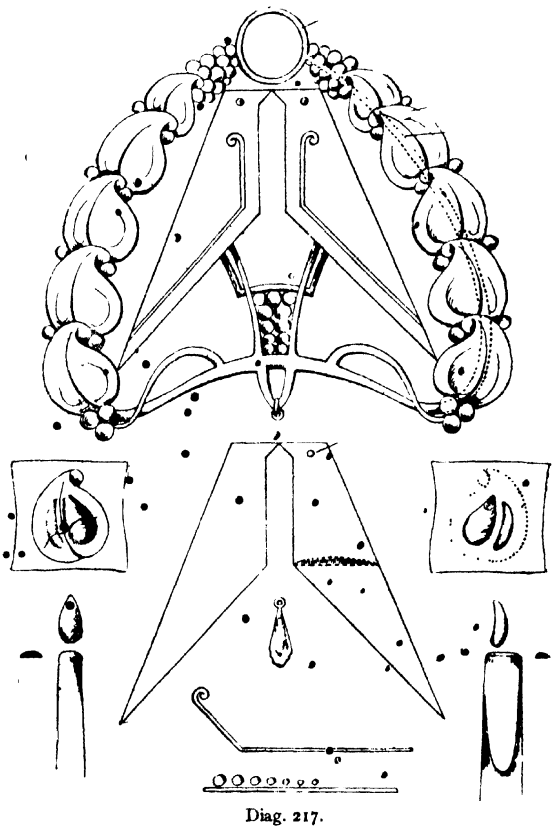
Exercise 18.—Beating out a fused end of round wire with a hammer to a leaf form (Diag. 216).



Diag. 216.



Diag. 218.



Diag. 217.

Exercise 19.—The adaptation of various details including jewels, wire, leaves, grains, and sheet metal (Diag. 217).

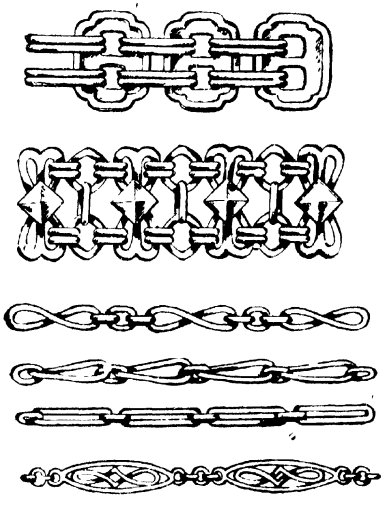
Exercise 20.—Combining chain links by the use of "jump" rings (hard or soft solder) (Diag. 218).

Exercise 21.—Various forms of chain links from pierced, plaited, and drawn wire (Diag. 219).

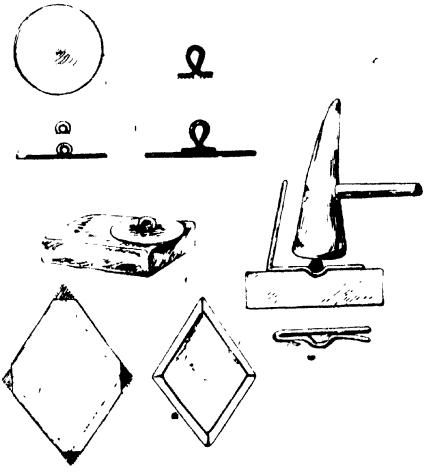
Exercise 22.—Small buttons, their preparation (Diag. 220).

Exercise 23.—Various scrolls, single and compound, from plain and twisted wire (Diag. 221).

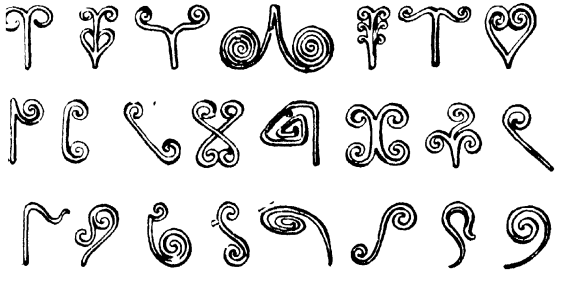
Exercise 24.—The making of a hat-pin socket (Diag. 222).



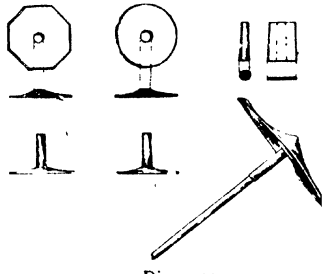
Diag. 219.



Diag. 220.



Diag. 221.



Diag. 222.

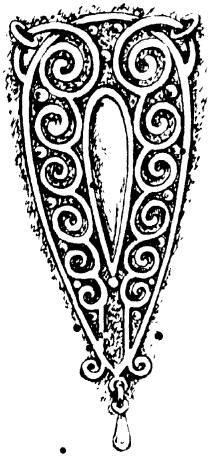
Exercise 25.—Scrolls, their adaptation (Diag. 223).

Exercise 26.—Beaded and decorated wires produced by the application of various punches (Diag. 224).

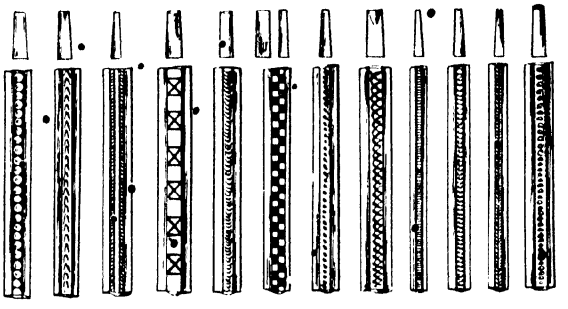
Exercise 27.—Spiral drops from thin wire (Diag. 225).

Exercise 28.—Development of small spoon from flat sheet metal combined with wire (Diag. 226).

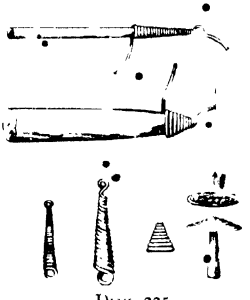
Exercise 29.—Small chased details (Diag. 227).



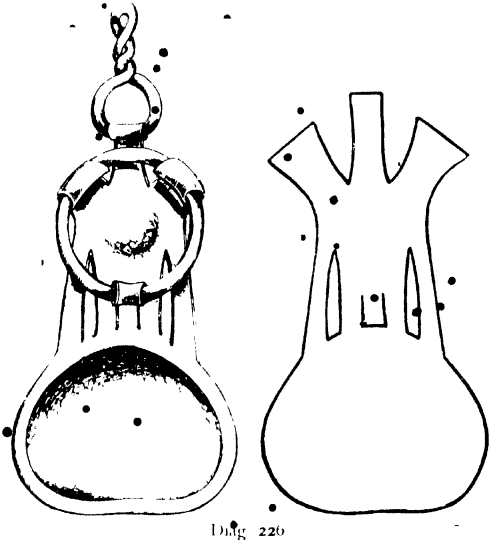
Diag. 223.



Diag. 224



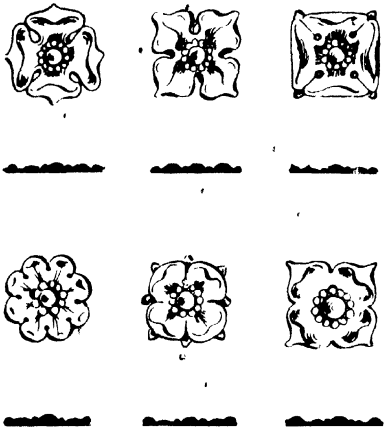
Diag. 225



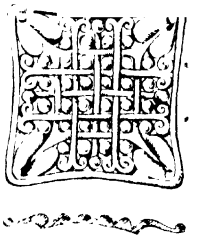
Diag. 226

Exercise 30.—Adaptation of wire, beads, and leaves (Diag. 228).

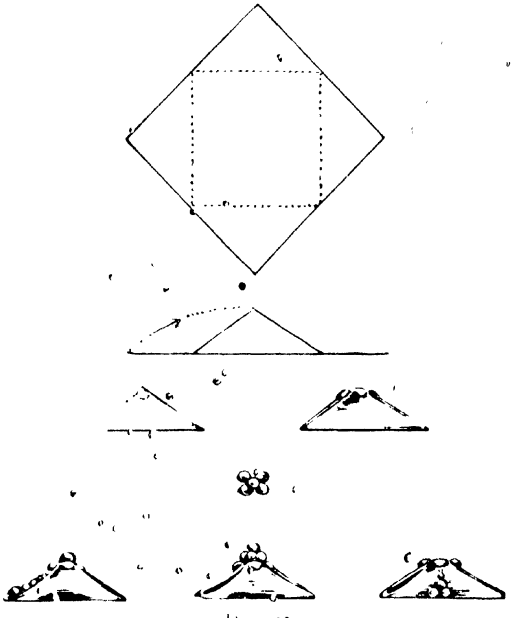
Exercise 31.—Small bosses, terminals, etc., from sheet metal and beads (Diag. 229).



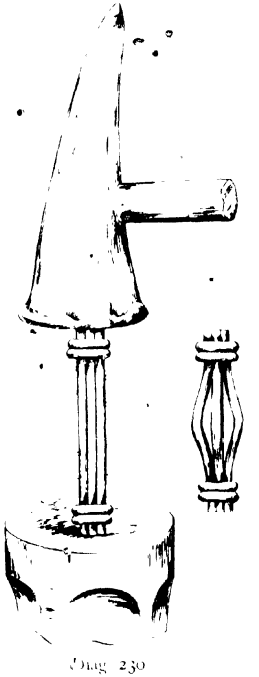
Diag. 227



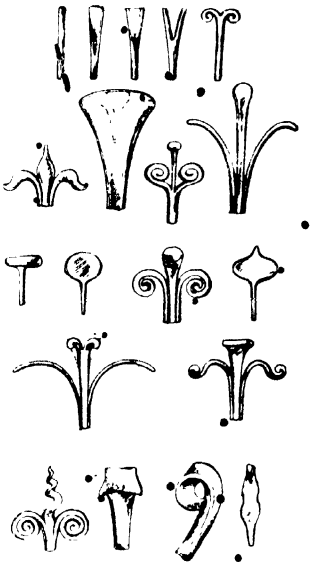
Diag. 228



Diag. 229

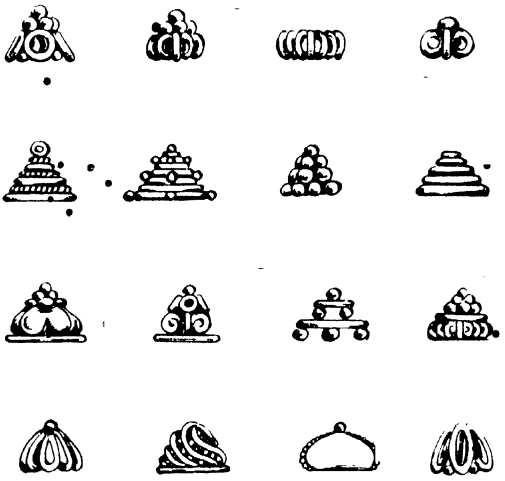


Diag. 230



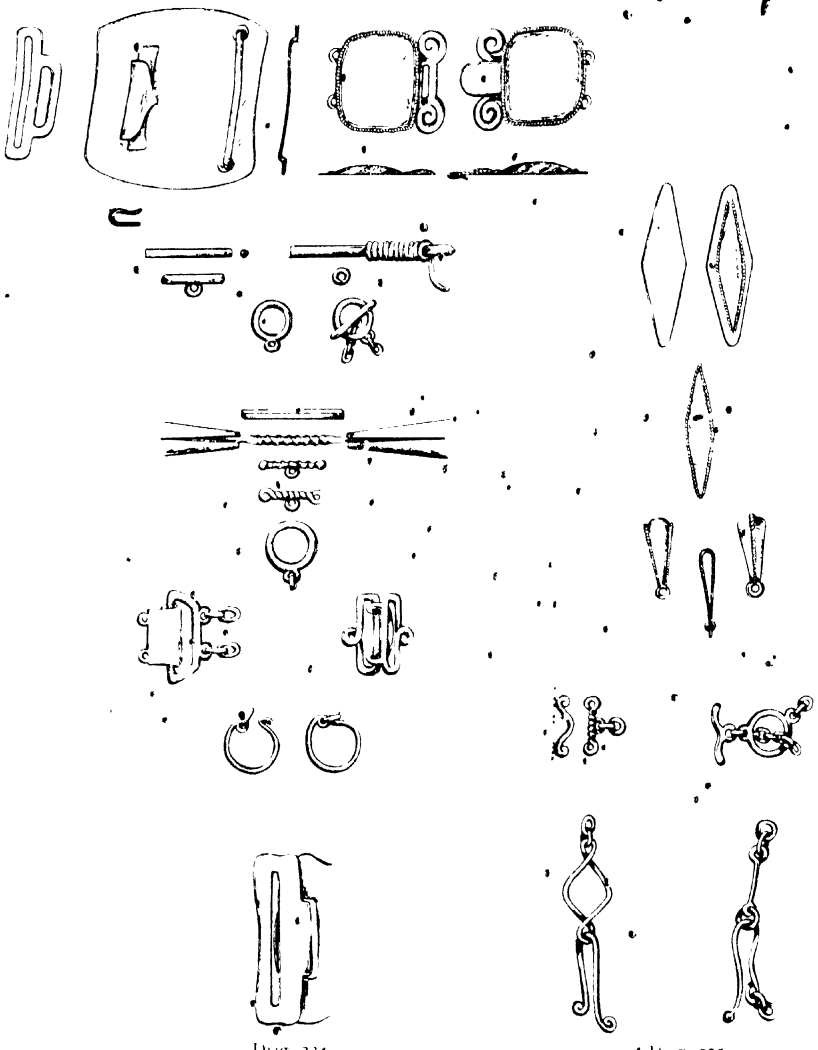
Diag 231

Diag 233



Diag 232

Exercise 32.—Wires soldered together at each end, and wrought open by an application of the hammer (Diag. 230).

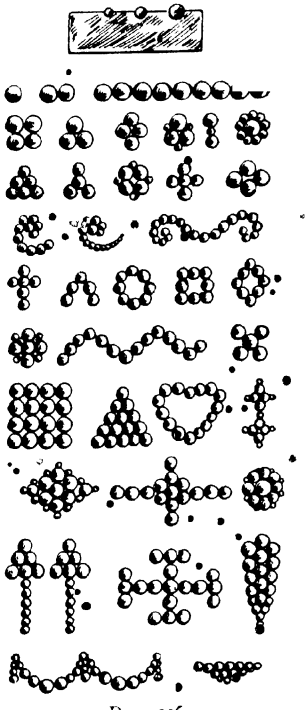


Diag. 234

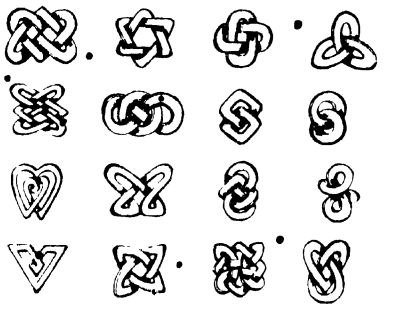
Diag. 235

Exercise 33.—Spirals and scrolls from narrow straps of flat metal, or round wire flattened with the rollers or hammer (Diag. 231).

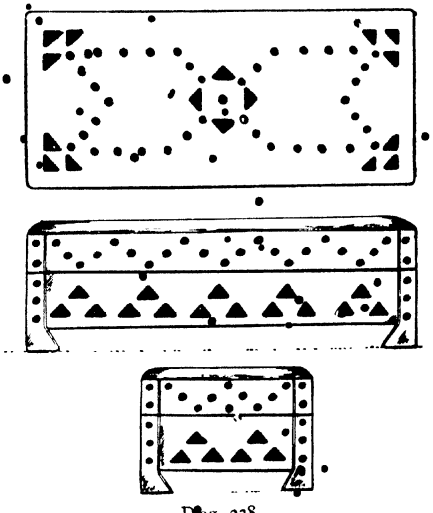
Exercise 34.—Terminals from rings and beads (Diag. 232).



Diag. 236.



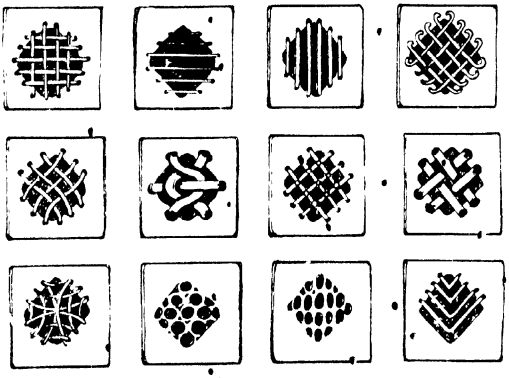
Diag. 237.



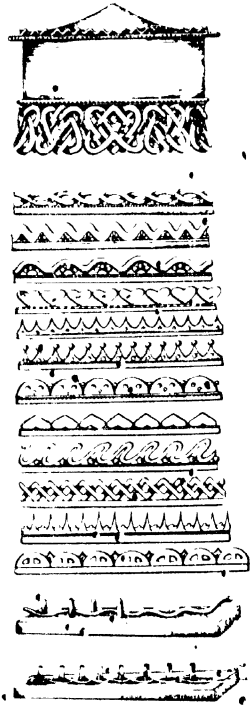
Diag. 238.

Exercise 35.—Overlay decoration (Diag. 233).

Exercise 36.—Bar and ring attachment for a pendant, made by combining the illustrated details (hard solder); also cloak-clasp fittings (Diag. 234).



Diag. 239

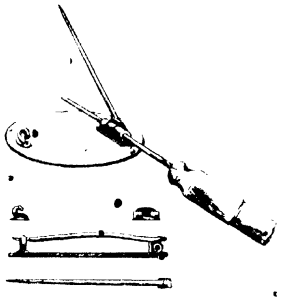


Diag. 240 Galerie Wires.

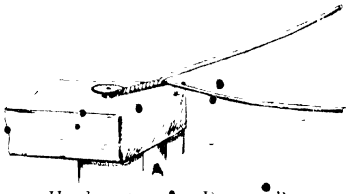
Diag. 242 - St George and the Dragon
Casting, Piercing, Enamelling

Exercise 37.—Loop and ring attachment for pendant, etc., made by combining wire, rings, and beads (Diag. 235).

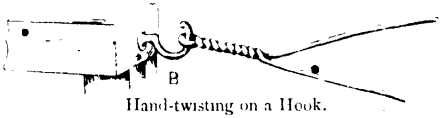
Exercise 38.—Fused beads from cuttings or rings (Diag. 236).



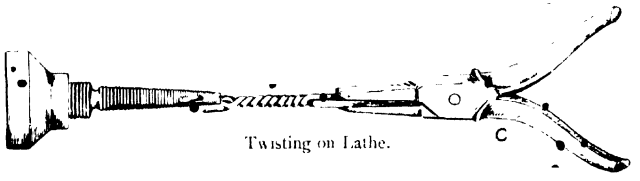
Diag. 243 Application of Pin Tongs.



Hand-twisting on a Drawing Pin.



Hand-twisting on a Hook.



Twisting on Lathe.

Diag. 244

Exercise 39.—Knots (various) in wire (Diag. 237).

Exercise 40.—Rivets in silver (adapted) (Diag. 238).

Exercise 41.—Wire or bands of metal interlaced to form a grille or trellis (Diag. 239).

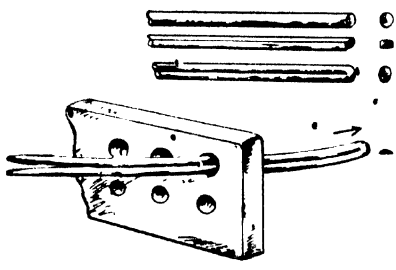
Exercise 42.—Galerie decorations (various) (Diag. 240).

Exercise 43.—The soldering of small details will be simplified by grouping on a thin tube of metal (Diag. 241).

Exercise 44.—Pendant, "St. George and the Dragon," introducing casting, chasing, piercing, and enamelling (Diag. 242).

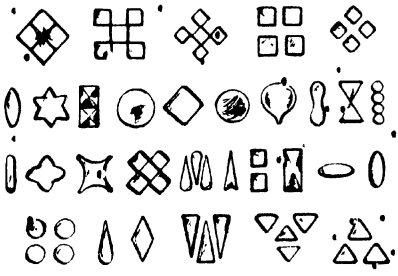
Exercise 45.—The fitting of a brooch-pin (Diag. 243).

Exercise 46.—Three methods of twisting wire (Diag. 244 A, B, and C).



Diag. 245.

Diag. 246.



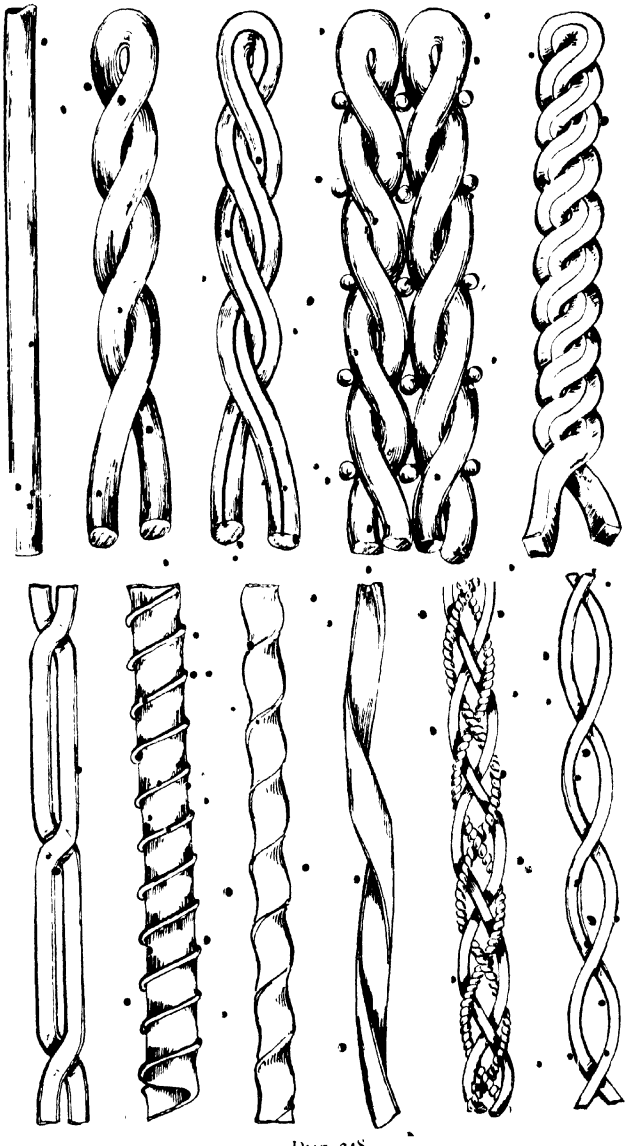
Diag 247.

Exercise 47.—The formation of half-round wire from circular holes in the draw-plate (Diag. 245).

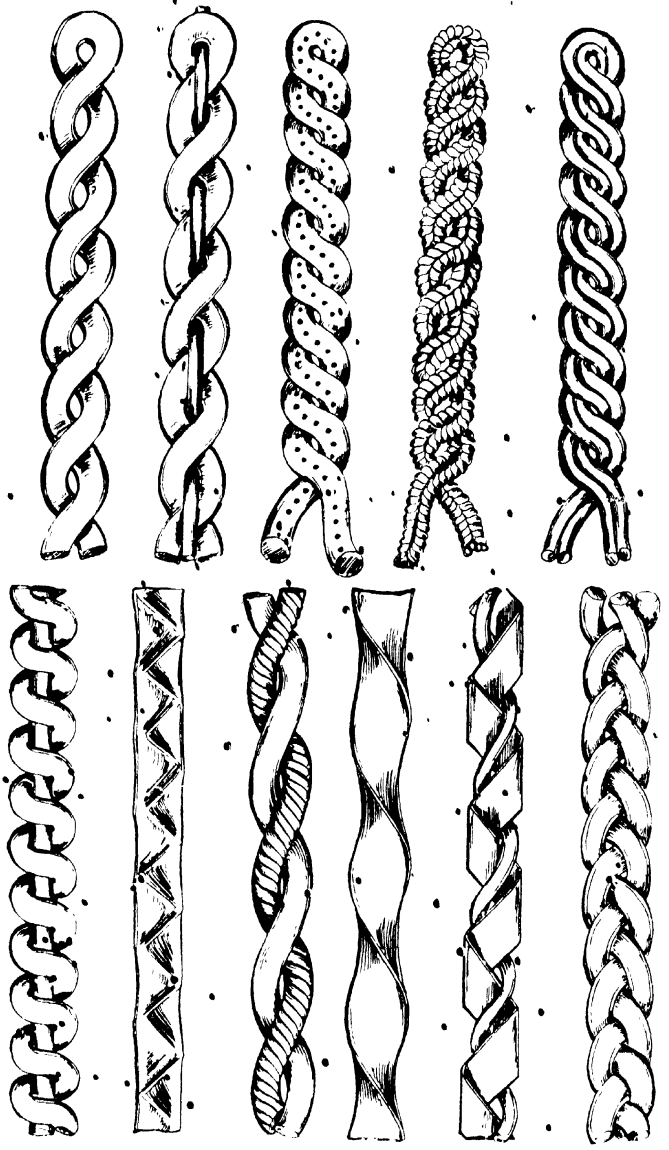
Exercise 48.—The use of a pitch stick in chasing a ring or similar object (Diag. 246).

Exercise 49.—Squares, triangles, circles, etc., in metal may be grouped as illustrated (Diag 247).

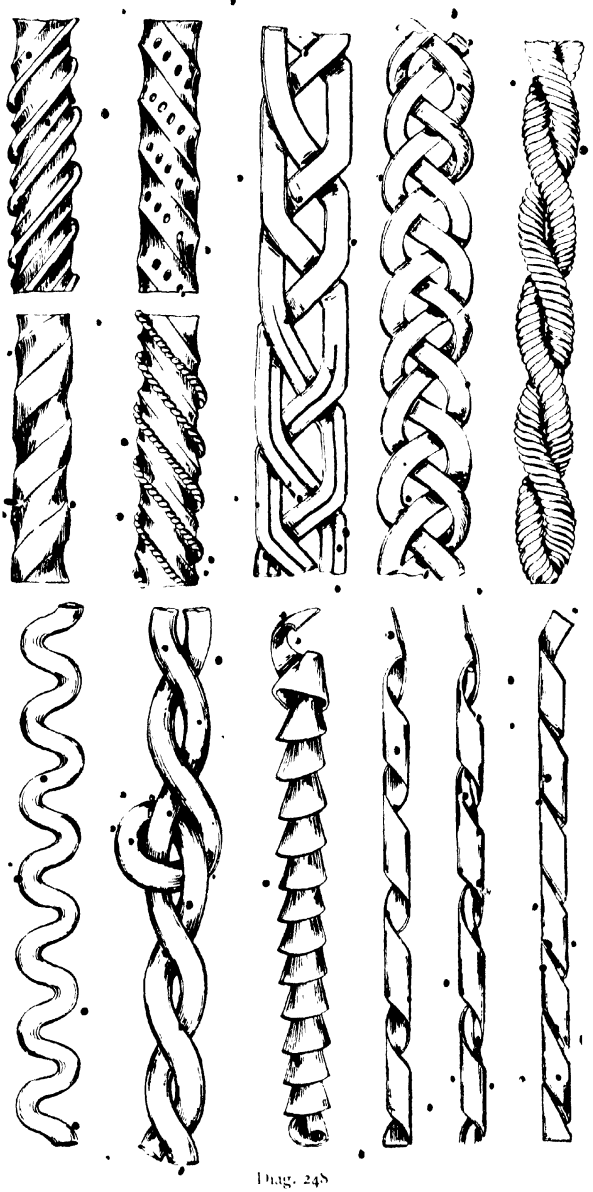
Exercise 50.—Various plaits, twists, and other decorations in solid and tubular wire (Diag. 248, Nos. 1-14).



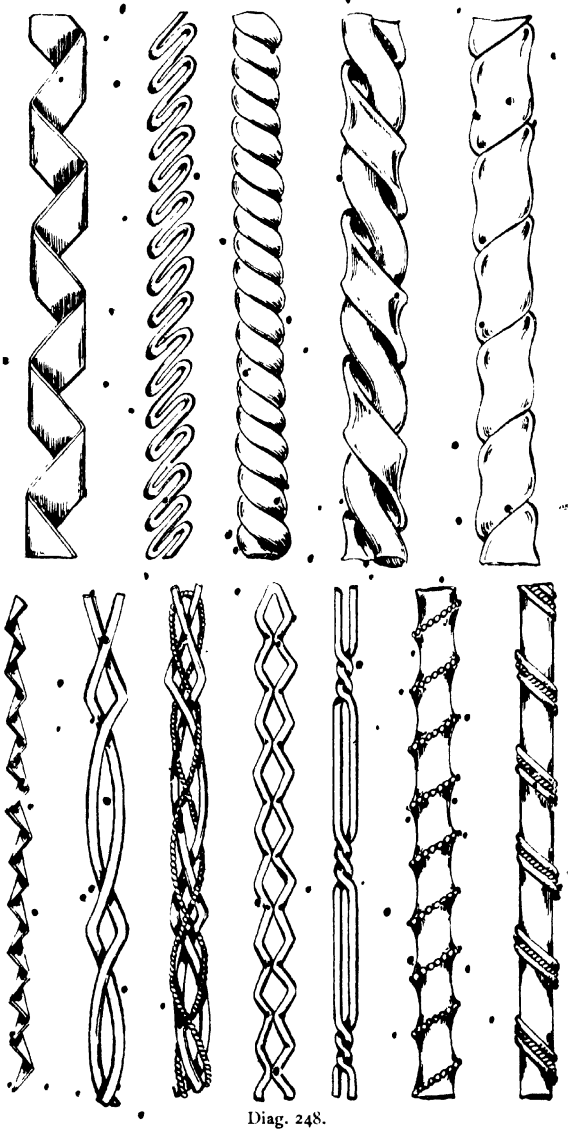
Diag. 248.



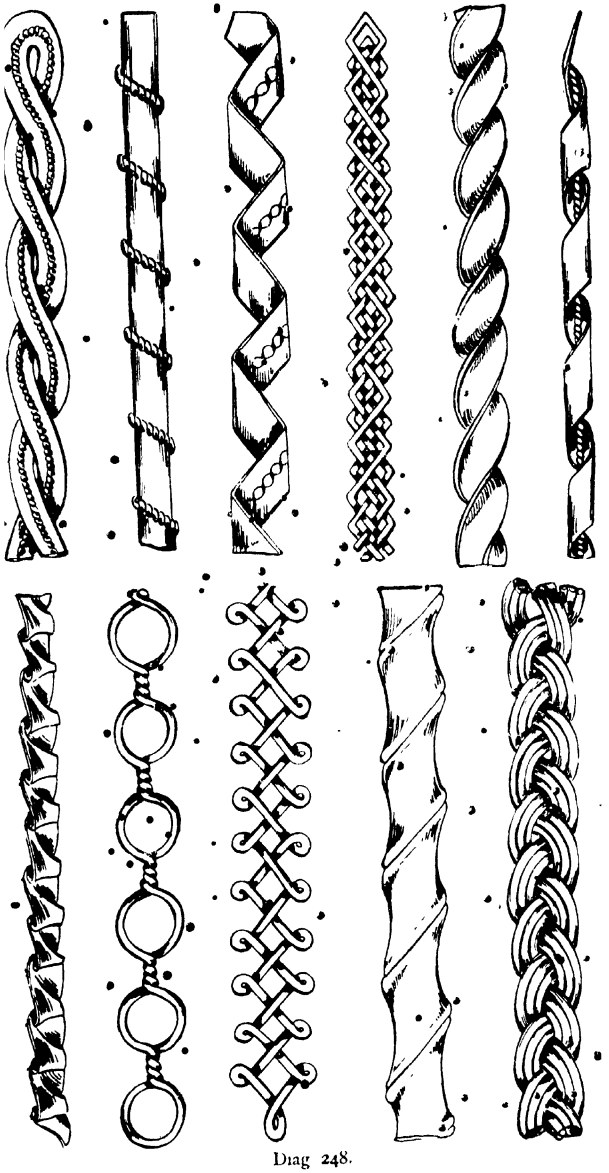
Diag. 248.



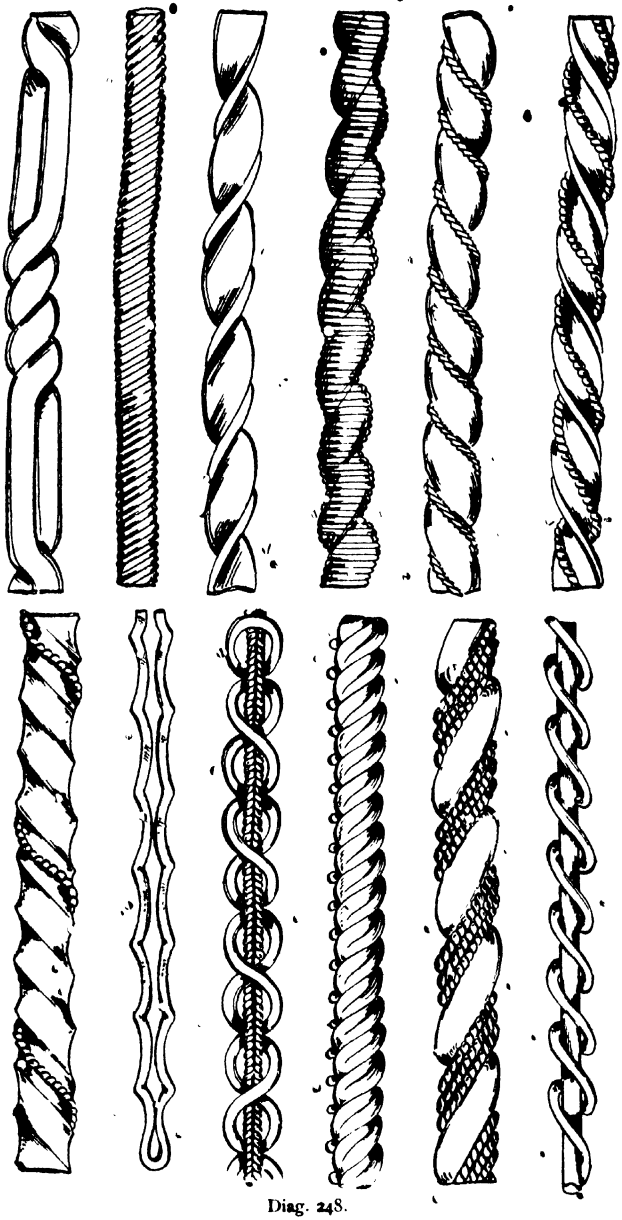
Diag. 248



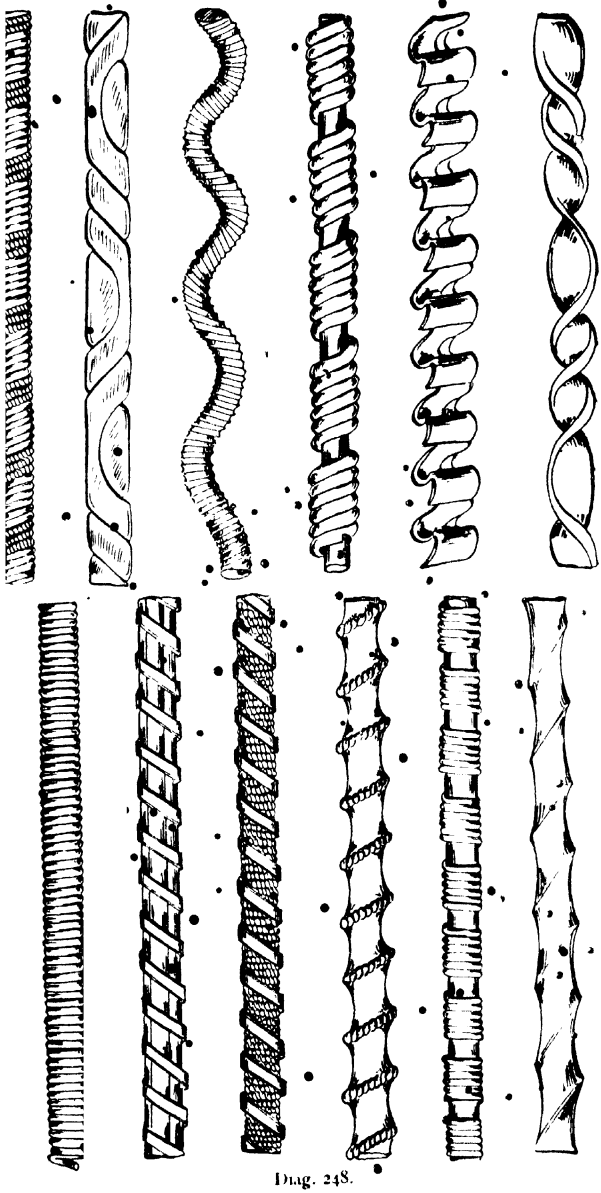
Diag. 248.



Diag 248.

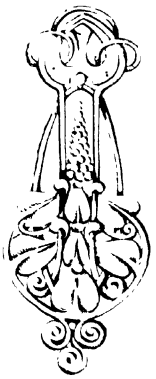


Diag. 248.



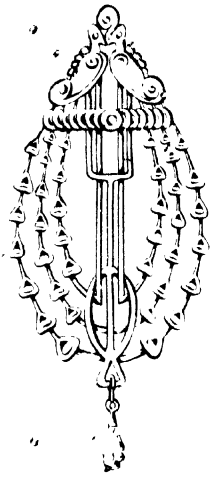
Diag. 248.

Adaptation of the previous Processes.

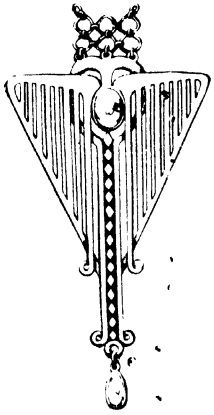


Diag 249.—Pendant in Gold, with Pierced Bird, Beads, Leaves, and Spirals.

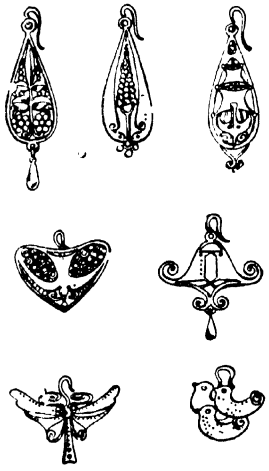
Diag 252 – Pendant in Pierced, Chased, and Wired Decoration



Diag 250.—Pendant, "Peacock," in Gold, with Pearls, Rubies, Pierced and Chased Decoration.



Diag. 251.—Pendant in Pierced Silver, with Jewels and Niello.



Diag. 253 —Earrings in Gold (various).

CHAPTER XIX

SETTINGS, THEIR VARIOUS STYLES

In the setting of stones, enamels, cameos, etc, there are certain recognised styles, varying from the plain band of metal to the decorated and intricate claw, coronet, and "galerie" settings, all more or less adapted to the shape and form of the jewel.

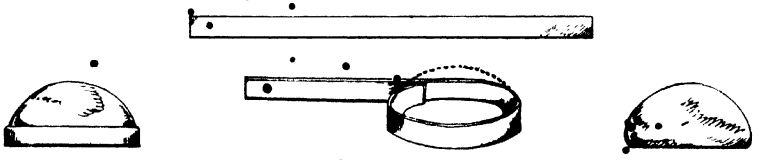
Let the principal consideration be perfect form combined with a harmonious blending of colour.

This effect will be more easily obtained with the "cabochon," or tallow drop "cut," with its rounded contour and quiet colouring.

Appended are the principal styles as applied to modern jewellery and craftwork. All are subject to variations, but originally are based on one or other of these recognised methods.

Close setting.	Paved setting.
Open setting.	Bezel or collet setting.
Gipsy setting.	Wired setting.
Crown setting.	Roman setting.
"Galerie" setting.	Threaded and grained settings.

The Close or Box Setting in its simplest form is a plain band or



Diag. 254

collar of metal, tightly fitted and soldered to embrace the stone (Diag. 254).

In fitting, cut a strap of silver with the shears, size 5 or 6, metal gauge, and size 25 or 26 in brass or copper, Birmingham wire gauge.

In cutting, keep the band of metal a shade deeper than required (Diag. 254).

Anneal the metal to soften, and fit it closely to the stone, also mark the exact position of the seam with a scratched line.

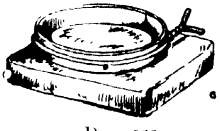
Carefully mitre the seam, and bind it with thin iron wire.

A paillon or snippet of solder previously immersed in the borax paste may now be lifted with the tweezers and placed evenly on the joint.

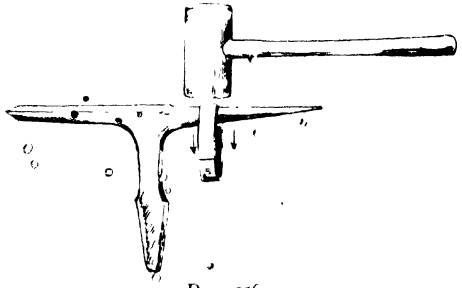
Rest the collar of metal during this process on a charcoal block or soldering wig (Diag. 255).

Light work must be soldered with a mouth blow-pipe.

Apply the flame very lightly at first to absorb the moisture; gradually increase and heat up the heaviest part of the work, then concentrate



Diag. 255.



Diag. 256.

the heat exclusively to the seam, which will result in the solder flowing freely and producing a sound joint.

Boil out when cold in the sulphuric pickle, then scour thoroughly with powdered pumice or bathbrick, afterwards rinsing in water and drying off.

Any surplus solder must now be filed away, and the collar trued up on a tapering stake with a small mallet (Diag. 256).

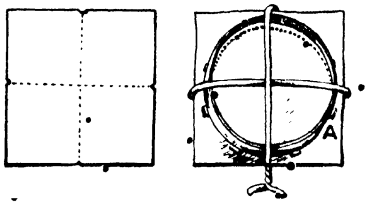
Aim at a keen fit; if too tight it can easily be stretched with a light planish from a steel hammer, while resting the metal collar on the above stake.

Level the collar with a few "rubs" on the face of a flat, smooth file, and mount it on a sole of metal, size 7 or 8 in silver, and 22 or 23 in brass or copper.

Insert four notches with the edge of a file to prevent the binding wire slipping during the soldering (Diag. 257).

Arrange the solder along the seam as illustrated at A.

When soldered, clean away all residue, and pierce out the centre of the setting with a drill or fretsaw, with the exception of a narrow rim or bearer to rest the stone (Diag. 258 A).



Diag. 257.

Diag. 258.

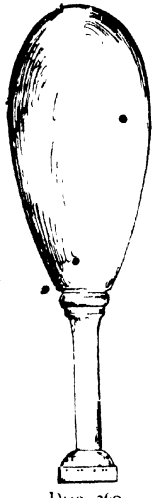
If the stone is opaque in colour, the fretting will be unnecessary.

Place the stone in position with a tapering piece of chaser's wax, or a wax stick (Diag. 259)

Diag 259.

Diag. 259A.

Diag 259B.



Diag. 260.

If it sits too low, reduce the rim of the collar with a smooth file (Diag. 259A), or insert a narrow inner bezel to heighten its position (Diag. 259B)

With the stone carefully fitted, and the metal polished, press it into position with the brass pressing tool (Diag. 260).

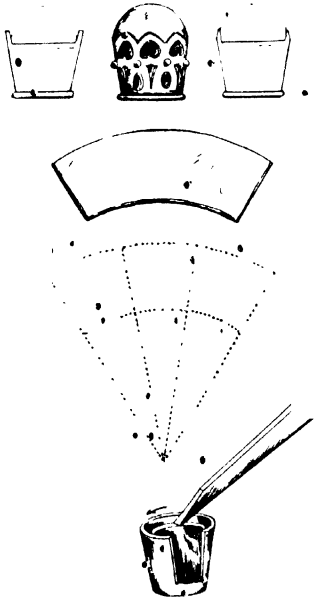
The three-cornered scraper may now be applied in working a narrow, close bevel along the edge of the setting (Diag. 261), afterwards using the burnisher for smoothing and completing the work (Diag. 262).

Various foils may be introduced behind the stones in close settings to heighten the colour effect.

The Open Setting constructionally is similar to the close setting.

Diag. 261

Diag. 262.



Diag. 263.

The main difference lies in the breadth of collar required to allow a fretted decoration. A slightly heavier weight of metal will be necessary; if in silver, size 10 or 12, and size 22 in the baser metals.

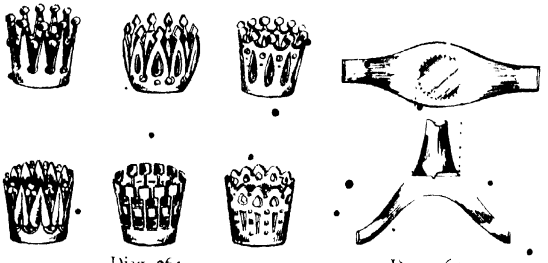
This additional thickness admits of a small ledge or bearer being pared from the inside of the band with the graver. The stone latterly rests on the ledge as illustrated (Diag. 263).

A greater breadth of collar will be necessary for elaborate decoration.

The piercing saw, drill, graver, and chisel may all be utilised in this

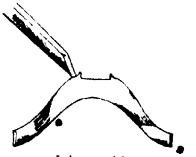
work, according to the style of ornamentation and transparency desired in the setting. Diag. 264 will convey various adaptations of this style.

Its success is dependent mainly upon the correct fitting of the stone, combined with a delicate treatment of the piercing.



Diag. 264.

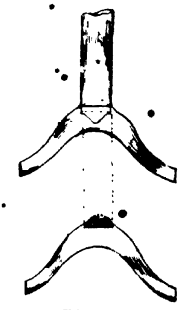
Diag. 265.



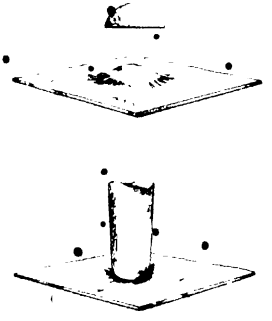
Diag. 266.

The Gipsy Setting is mainly applied to finger rings, where its pronounced and mystical effect is most desirable.

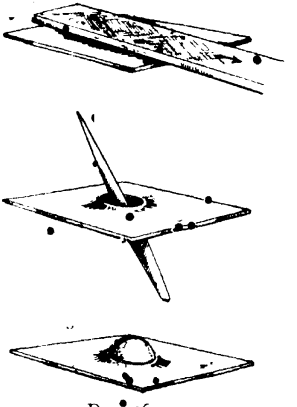
Its execution consists in drilling or sinking a cavity exactly to the shape of the stone (Diag. 265).



Diag. 267.



Diag. 268.



Diag. 269.

With a round needle-file or graver cut the metal surrounding the cavity, with the exception of the narrow rim of metal as illustrated in Diag. 266. Soften the metal and place the stone well into the cavity with the brass pressing-tool (Diag. 267).

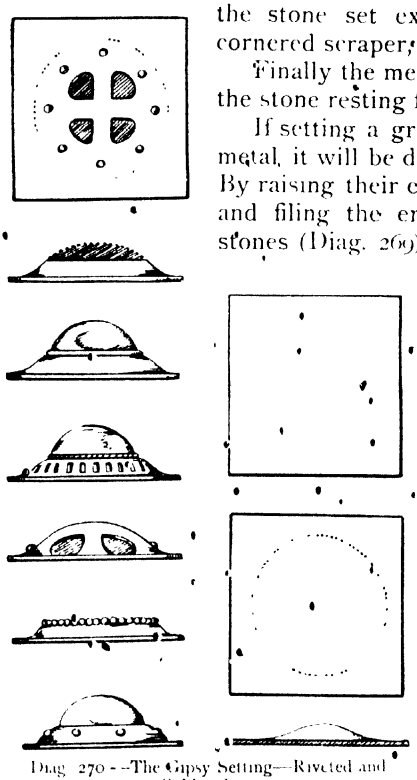
The matting-punch and hammer must now be carefully applied to draw the wall of metal slightly over the stone.

If well greased and secured with chaser's cement on a bullet, the stone will be less liable to chip during the process.

Greater safety will be assured if an extremely fine rim is cut, and the stone set exclusively with the graver, three-cornered scraper, and burnisher.

Finally the metal must be nicely rounded off, with the stone resting flush with its surface.

If setting a group of stones in this style on thin metal, it will be desirable to let them in from behind. By raising their exact shape in repoussé (Diag. 268), and filing the embossed parts open to admit the stones (Diag. 269), a perfect "flush" setting will be attained. A thin and perfectly fitting plate of metal must now be "soft" soldered from behind to retain the stones. Afterwards finish off any surplus solder with the file, scraper, and water-of-Ayr stone. The seam may be plated or lacquered to hide the solder, and produce a uniform colour.



Diag. 270.—The Gipsy Setting—Riveted and Soldered.

For larger work rivets may be substituted for solder in the execution of this style (Diag. 270).

The Crown, Claw, and "Galerie" Settings (Diag. 271) form a grille or perforated rail.

The "galerie" wire may be purchased in entire length, but lacks the feeling of hand-wrought work (Diag. 240).

The "crown" is similar to the claw setting, with its "claws" or "forks" of metal clutching the jewel.

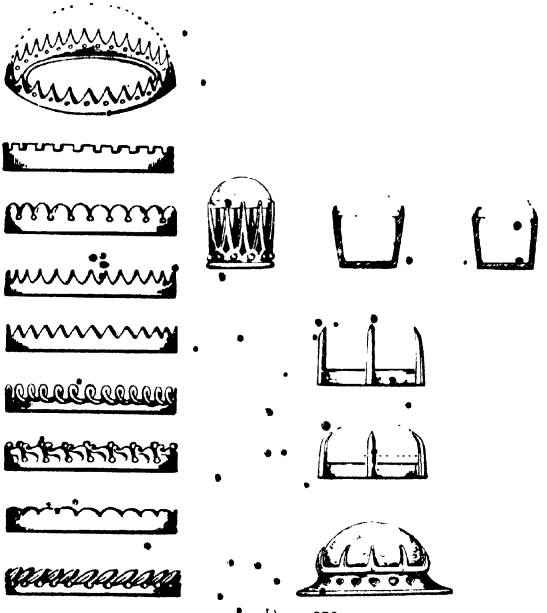
The style is well suited for strong effect, or in larger and heavier work such as dirk handles, snuff-mulls, scabbards, etc. (Diag. 272).

Paved Settings suggest a delicate harmony with the metal and jewel. A "bed" or trench is cut with the graver or chisel, suitable in size and depth to the stone (Diag. 273).

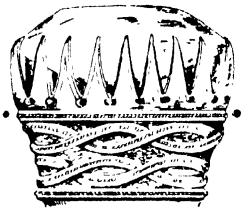
Around the line of the stone an incised line is cut (Diag. 274); afterwards slope its edge towards the stone with a scorper (Diag. 275).

After smoothing and polishing, the stone is inserted, and the narrow metal rim wrought evenly over its edge with the scraper and burnisher (Diag. 276).

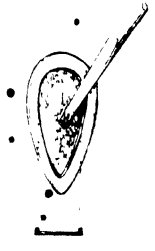
Bezel or Collet Settings, as their names imply, are similar to a close setting, only much deeper, and with a slight taper towards their base.



Diag. 271



Diag. 272



Diag. 273

A narrow bearer may be cut, or small wire soldered in, to bed the stone (Diag. 277).

In its execution use size 10 or 12 in silver, as the pierced or carved decoration demands a fair strength of material.

Wired Settings are mainly an exclusive application of the metal (principally wire) to obtain unique effects.

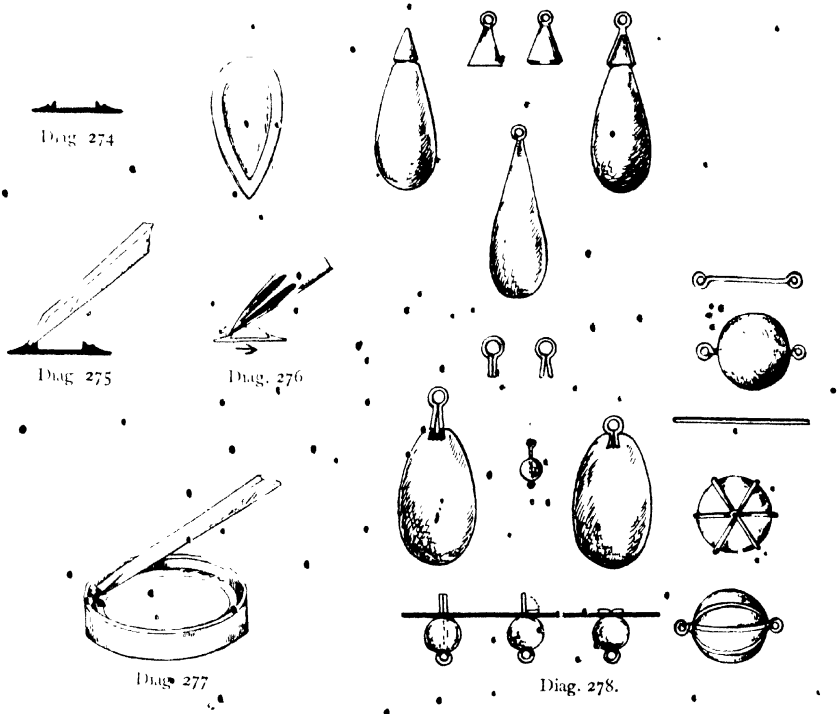
In perforated jewels, beads, etc., their use is indispensable (Diag. 278).

Roman Settings are principally used in setting flat stones, seals, or similar panels.

The stone is first bedded on a suitable bearer, previously cut with the graver. A narrow groove is then cut, and the remaining thread of metal (Diag. 270) carefully wrought and burnished over.

Circular settings may be turned on a lathe to the desired size and shape.

Threaded and Grained Settings are applied to suit low set or



Diag. 274

Diag. 275

Diag. 276

Diag. 277

Diag. 278.

closely grouped stones. A shallow bed is first drilled to their exact size and position (Diag. 280).

With a spitsticker, or small, pointed cutting chisel, a tiny sloping cut is inserted between each stone (Diag. 281). A small magnifying-glass may be employed in this work.

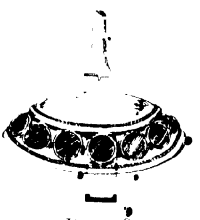
The resulting "peck" of metal (well annealed) is now carefully modelled, and burnished with the graining tool, until a dainty, circular bead locks the stone in position (Diag. 282 A and B).

Diag. 283 will suggest several varying applications.

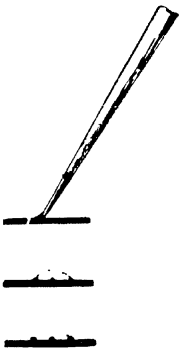
Cement Settings.—In certain types of work the use of a cement is quite permissible as an aid to a setting.

The well-known **Armenian Jeweller's Cement** will be found perfectly reliable for that purpose.

Diag. 279



Diag. 280.

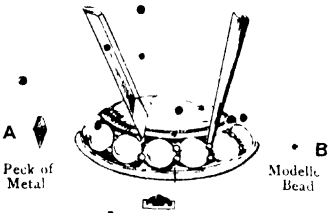


Diag. 281

The following proportions will provide a strong fixitive.

Take 4 or 5 pieces of gum mastic, and reduce them to a thin gum in sufficient alcohol, also an equal quantity of isinglass previously softened in water; latterly add a few drops of nitric acid and a little white of an egg.

In fixing jewels, enamels, cameos, or glass to a metallic surface with cement, aim at a uniform mild heat in all the mediums, otherwise an equal cohesion will be impossible.



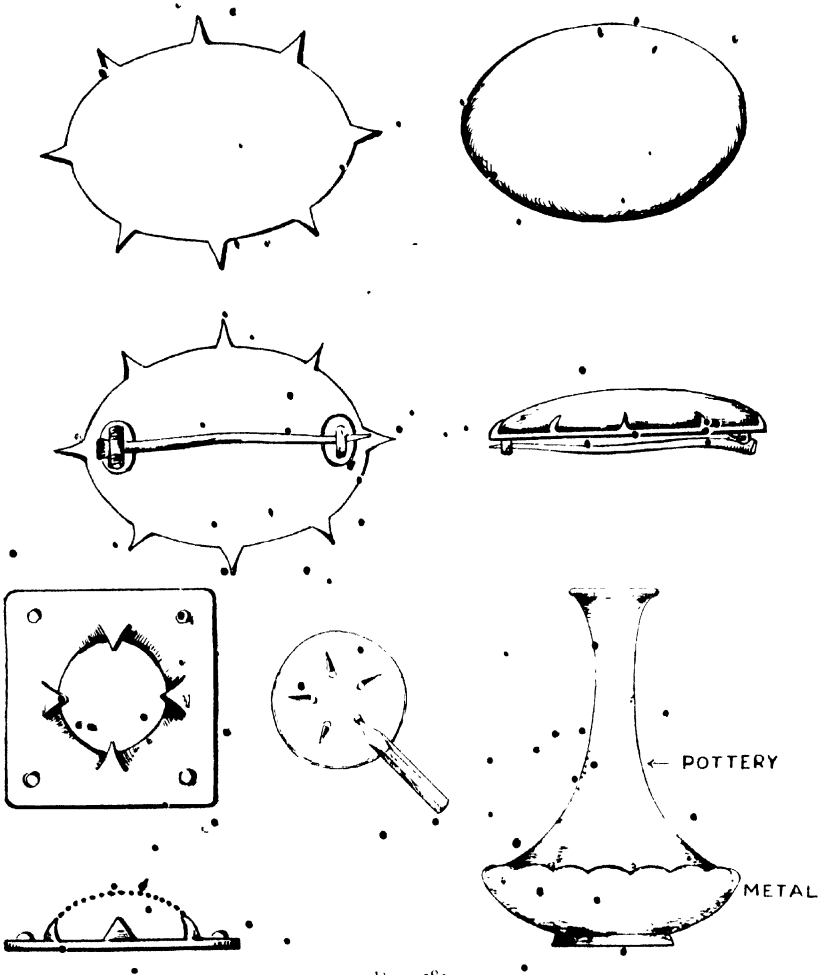
Diag. 282

Concrete for Jewellery, Enamel, and China.—Immerse in sufficient proof spirit 10 oz. of gum arabic with the addition of a small quantity of litharge (oxide of lead).

Turquoises, opals, moonstones, chrysoprases, pebbles, mother-of-pearl, or other unique shells, may easily be adapted by the student, by grinding and polishing on a small lathe or polishing head. If the use of a lapidary's wheel can be obtained, more direct and ambitious work may be attempted.

If cutting the stone with the hand alone, use the corundum file

and water; if on the wheel, a little glycerine may be used as a lubricant.



Diag. 283

A cement stick (Diag. 307) can be prepared for retaining the jewel in position.

A yielding cane sufficiently long to furnish a hand grip, and with a blunt end coated with Setter's cement prepared from the following recipe, will fix the stone:—

Resin	1 part
Plaster-of-Paris or brickdust	1 „
A few flakes of shellac and shavings of tallow.	

Warm the cement stick slightly and press in the stone until it is securely fixed.

If irregular depressions are prevalent on the obverse side, as in a pearl matrix, protect it from the cement with a small cap of gold-beater's skin or tissue paper.

The polishing may now be executed, first on an emery wheel of moderate grade, and gradually introducing a finer medium as the face of the stone develops.

A Leather Buff with powdered emery and water will follow, and a finish with oil and putty powder.

Enamels, Niello, or other inlays, may have a similar surface finish.

Flat Shells may be cut to various forms with the fretsaw, using a little beeswax in its application.

The **Drilling of Stones** is beset with certain difficulties, which demand great care and patience to overcome.

For reliable work a seal-engraver's lathe-head is practically necessary to ensure a true and high-speed action. A grit will be required in combination with the drills to supply a cutting surface.

Still, with the ordinary hand-drill carefully applied, and the object well secured, many of the softer stones, nuts, seeds, or similar objects, may be safely pierced and applied decoratively.

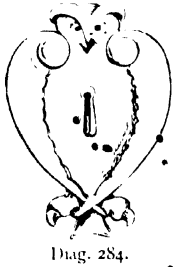
Many of these forms may be secured if pressed into a piece of end wood well moistened, and the drill applied while the work rests in the cavity.

CHAPTER XX

PATTERN-MAKING, MOULDING, AND CASTING

PREPARATORY to the production of a casting, the matrix or pattern must be prepared either in a solid or hollow form, by means of which a replica in plaster-of-Paris or metal can be obtained.

The art of founding itself has been aptly described as merely sinking a cavity in the sand, and "charging" it with molten metal.



Diag. 284.

Diag. 285.

This description is simple, but lacks the necessary detail which the higher branches of the craft embody, and wherein to succeed demands regular practice and patient study.

The Matrix Pattern or Mould may be made in various mediums, viz. metal, wood, wax, clay, sand, plaster of Paris, bathbrick, cuttle-fish bone, or slate, each material possessing certain qualities suitable to different styles and sizes of work.

The Metal Matrix is mainly applied to light work, where clean lines and intricate forms predominate. Therefore a chased matrix in brass or copper will prove the most suitable for this type of work. Diag. 284 is an example of the above style.

After chasing the matrix, if too light, back up the cavities on the obverse side with soft solder, wax, or plaster-of-Paris.

Wood is almost exclusively used for patterns requiring size and weight, as in parts of machinery, tools, or various forms of dies, also where the turning lathe can be applied to greatest advantage.

If executing a small matrix use a hard wood, boxwood being preferable (Diag. 285).

Soft woods after polishing may exhibit a "pile"; this objectionable surface may be "laid" before inserting in the sand with a thin application of shellac varnish. The above varnish can be easily made by reducing a small quantity of shellac in spirits of wine.

Diag. 286

Modelling Wax will produce a matrix superior in many respects to one executed by chasing.

The latter method has a tendency to be hard, whereas the softer material is more sympathetic to the touch of the hand or modelling tool (Diag. 286).

Its perfect adaptability in the production of small figures, etc., as a result of the waste wax process (p. 147) cannot be over-valued. Plasticene, being of a similar nature, is useful for small details, but exhibits a tendency to oxidise silver and gold.

Recipe for Modelling or Chaser's Wax –

Pure Beeswax	½ lb.
Olive oil	¼ pint
Flour	¾ lb.
Shavings from a tallow candle.	
Small quantity of colouring matter to render it opaque.	

Melt the ingredients in a jar immersed in boiling water.

Insert the beeswax first, then add the oil, and gradually stir in the flour. The shavings of tallow may be reserved until the last, to supply ductility to the mass. Continued kneading will perfect its condition.

Modelling Clay is indispensable for all general work, it will also respond freely to the touch, and in conjunction with plaster-of-Paris is invaluable to the caster.

Sand Moulding embraces the most varied work in the craft, irrespective of whether it be piece moulding, solid, or cored castings. In its practice there is much to learn, final success being chiefly dependent upon the condition of the sand, insertion of the vents and runners, facing, and final "charging" of the molten metal.

Plaster-of-Paris to the caster is a most adaptable medium, either for large or small work. For the preparation of moulds, preparatory to the carrying out of a casting, it has few equals.

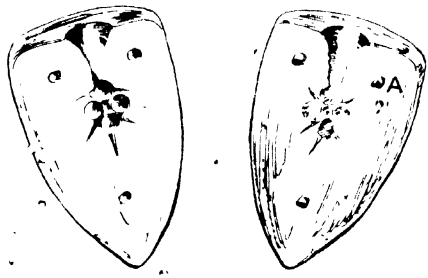
If thoroughly dried, castings in tin and antimony, lead, or pewter may be successfully taken off its surface, while small castings in gold and silver may be successfully attempted.

Bathbrick, Cuttle-fish Bone, and Slate are all convenient mediums for the craftsman where small details in the precious metals are required. The mould is pared from the bathbrick surface, in a similar manner to the cutting of a die; a "gate," or pour, and the additional air vents are then incised on its face previous to the pouring of the metal (Diag. 287).

Slate, although harder, is more durable, and admits of many "repeats"; much of the older work was produced from this medium. The graver will readily incise its surface.

The Cuttle-fish Bone may be used as casting flask (in miniature) by carving the desired form directly on its surface, or by inserting a matrix between two perfectly flat pieces of cuttle-bone, and with pressure securing a true impression of the object.

Diag. 287. Slate Mould.



Diag. 288.—Cuttle-fish Bone Mould.

To ensure a perfect mitre of the halves insert three small register pins (Diag. 288 A).

Afterwards paint the face of the mould with a solution of silicate of soda, borax, and water, which will strengthen and prepare its surface for the metal. Prepare the above ingredients, half-and-half, with water, and apply with a soft brush when in the consistency of a paste. Give the matrix a dusting with French chalk, or black lead, and again insert it into the cuttle-fish mould. This final impression will smooth the surfaces, and sharpen its edges.

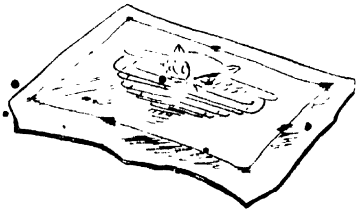
Withdraw the matrix and bind the cuttle-bone moulds together with iron binding wire, previously making sure that they are thoroughly dry.

Melt the metal in a crucible, or in a cavity of charcoal, and place the mould slightly under to receive the molten stream (Diag. 289).

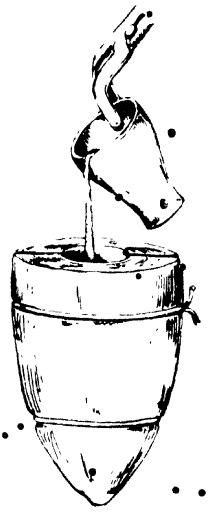
The following exercise, implying the production of a casting in soft

metal from a matrix of wax or clay, will serve as a simple introduction to the practical part of the craft.

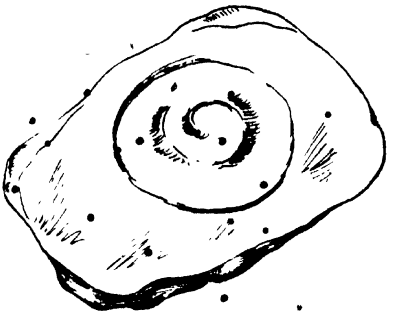
A Surface of Glass will provide the most suitable background for the modelling of the work. Its smoothness permits of an easy removal of the plaster mould after casting; while its transparency allows irregular shapes and sizes to be easily followed in wax or clay, if a paper outline of the design is attached to the under side of the glass (Diag. 290).



Diag. 290.—Modelling over a Glass Surface.



Diag. 289.—"Charging" the Metal.



Diag. 291.—The Plaster-of-Paris Mould.

With the completion of the modelling, prepare the plaster-of-Paris by mixing it in water to the consistency of a thick cream; then apply it first as a thin, even layer free from air-bells; as the medium "sets" build up the mould to the thickness of an inch.

When thoroughly set, release the plaster cast from the glass background and carefully clean out the wax, or clay model (Diag. 291).

The Core (Diag. 292 A) may be inserted in the form of a thin layer of modelling clay or wax to insure lightness and a uniform thickness.

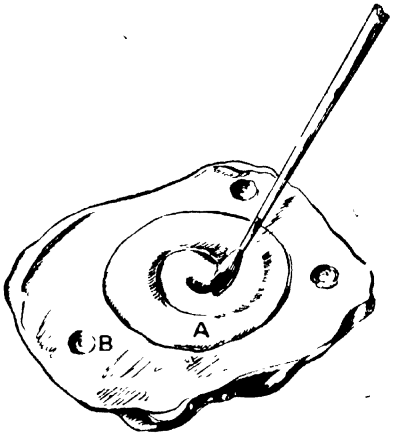
The Keying Pins (Diag. 292 at B) must now be cut to procure a perfect

mitre of the moulds when complete. A thin application of soap, or modelling clay wrought to the consistency of a paste, and well worked in with a soft brush, will prevent the plaster casts adhering. Now take a plaster cast off the core, removing it when fully set, and cleaning out the core of clay.

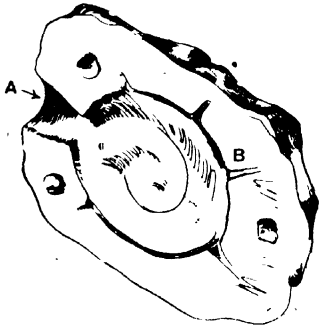
The "gate," or "pour," and air vents may now be inserted (Diag. 293 A and B).

This process will demand care and discretion, which can only be acquired after long and patient practice.

Prepare the Moulds for casting by thoroughly baking; to remove all trace of moisture, also warm and smoke their surface with a taper, or



Diag. 292.—The Cone and Keying Pins.



Diag. 293 A and B. The Gate and Vents.

tallow candle, previous to binding together and charging with the molten metal (Diag. 294).

The intervening spaces of the mould may be filled with modelling clay to prevent any of the metal escaping during casting.

Melt the Metal (lead, pewter, or tin and antimony), in an iron ladle with the addition of a small piece of resin as a flux, using a wisp of brown paper to skim off the dross. The correct degree of heat may also be judged by this paper which, if the metal is too hot, will burst into flame; but if it smoulders slowly, the metal may be applied to the mould.

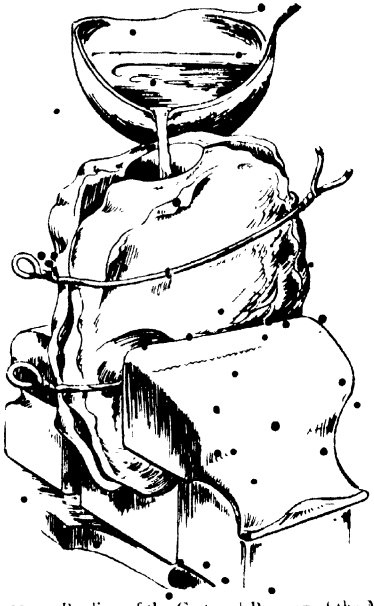
Pour the metal in a continuous, steady stream, and retain the ladle

well over the surface of the gate to obviate the danger of the metal spurting.

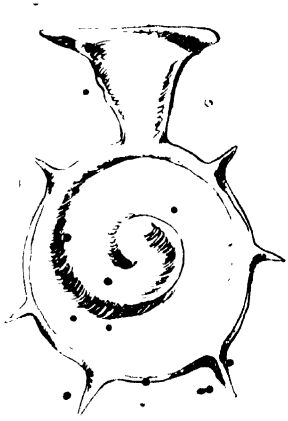
Diag. 295 will convey the condition of the metal cast after removal from the mould. The gate and vents may now be cut off with the saw or chisel, and finally trimmed with file and emery cloth.

If required, other defects may be improved with the repoussé punch.

The "Cire Perdue," or waste wax process of casting, provides the most satisfactory results in figure work or similar objects.



Diag. 294. Binding of the Cast and Pouring of the Metal.



Diag. 295. The Casting.

For a small solid casting the **matrix** may be prepared in casting wax. An entire mould is then taken off its surface.

Casting Wax may be prepared from any clean and free-flowing wax which leaves the minimum of residue.

Beeswax and a little Burgundy pitch, with an additional pinch of rouge as a colouring agent, will provide a satisfactory medium.

Reduce the above ingredients to a liquid, melting them in a jelly jar immersed in a pan of boiling water, and stir continuously until all are thoroughly mixed; afterwards knead the ingredients on a floured board.

If a few shavings from a tallow candle are added, greater ductility will prevail in the wax. Use the minimum of flour to avoid any residue.

The "gate," or "pour," will be supplied by fixing a tapering piece of wax to the top or bottom of the object. Always provide a fairly long pour, which will ensure a sounder casting.

Diag. 296.

The first surface of the mould may be taken in plaster-of-Paris, powdered bathbrick, alum, and water to bind the ingredients. Apply it in a uniform layer (Diag. 296), afterwards increasing its bulk with additional plaster-of-Paris, crushed fireclay, and sawdust (well mixed) to a thickness of 1½ inches for objects up to a foot in height.

If the work is secured in a sand-box or moulding flask, a thinner mould will be sufficient. A few iron wires may be inserted or bound round the cast to supply extra strength.

The mould must now be slowly dried and baked, with the gate projecting downwards, which will allow a ready escape for the melted wax.

Cored Castings demand much greater care and preparation to provide satisfactory results.

If the object is small and upright, a simple core of round iron wire coated with flour paste or thick whiting and water may be inserted (Diag. 297), afterwards withdrawing the core on the completion of the casting, and plugging the holes with metal.

Diag. 297.

Other methods include the production of a matrix in gelatine (which any plasterer will supply).

With the completion of the gelatine mould, the melted wax is poured in; immediately revolve the hollow mould in varying directions to ensure a uniform skin of wax filling every crevice.

The wax need not be thicker than ⅛ of an inch; this thickness will, if successfully cast, decide the body of metal.

When the wax is perfectly set, strip off the gelatine from its surface; a hollow model in wax will now be the result.

The outer mould of plaster, etc., may now be taken as previously described, and the rod of wire inserted to carry the core.

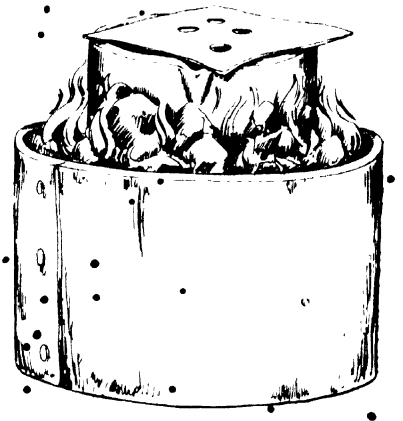
When the mould is thoroughly set, the core may be filled in, using in its preparation a fair quantity of granulated fireclay and sawdust.

The mould must now be carefully dried and the wax melted out

Smoke the interior of the mould (where possible) with a tar rope or wax taper, and charge the metal when the mould is warm.

Melt the Metal in a crucible—anneal the latter (if new) before use, which will lessen the danger of cracking

Place the pot on the fire (coke preferable) with the fuel well built round it (Diag. 298). A little powdered charcoal and sal-ammoniac may be inserted to clear the scum.



Diag 208

Pour the metal when in a bubbling condition into a hot mould or well-oiled ingot.

Sand Moulding implies the use of moulding boxes or casting flasks, and loam or moulding sand specially prepared.

It is composed mainly of fine silt from river beds, but may be improved by the addition of various ingredients, including treacle, sour ale, or fine cloth frayings.

These materials are inserted to produce the necessary grip and susceptibility to pressure needful to secure a clean casting.

All types and sizes of work are possible in the sand mould; their varying application and complex nature, however, demand practical work to obtain a thorough knowledge of the process.

Therefore, the following exercise is but a simple and elementary form of the work.

The Casting Flask is composed of two halves, the "eye" (Diag. 299), and the "peg" (Diag. 300).

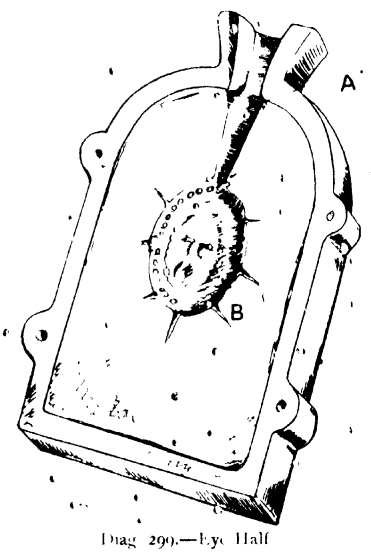
In preparing the sand mould, place the "eye" half on a flat moulding board; insert the matrix as illustrated (first brushing it with black-lead or French chalk). Now insert a smooth surface of sand by passing it through a fine sieve held immediately above the flask

Avoid having the sand too damp, just sufficient to respond freely to the pressure of the hand. The remainder of the flask may now be solidly packed, especially around the concave side of the box. A wooden beetle or mallet head may be utilised in driving in the sand.

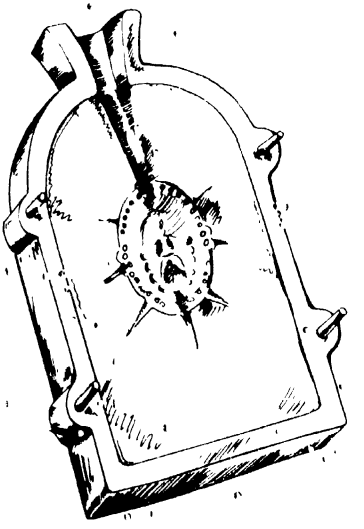
Pare away the surplus sand with a flat iron rod, afterwards reverse

the mould, and carefully insert the peg-half (Diag. 300). A dusting from a muslin bag of "parting" or "facing" sand (composed of fine bathbrick, pea flour, or powdered charcoal) may now be applied to the matrix and face of the "eye" half (Diag. 299), which will prevent the two halves adhering.

The "peg" half will now be filled with sand; when well packed and the surface levelled, apply a few thuds to the moulding board with a mallet, which will dislodge the matrix from the sand. The "peg" half must be carefully removed, and the "eye" half held



Diag. 299.—Eye Half


Diag. 300.—Peg Half.

face downwards, which will result in the pattern dropping out and a clear sand impression remaining. If it still adheres, a slight tap on its surface with a moulding tool (Diag. 301) will easily release it.

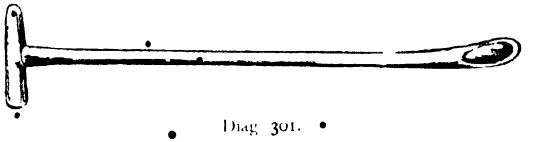
The "gate," or "pour" (Diag. 299 A), also the air vents, B, will now be inserted. Always insert a long pour, which will minimise the possibility of a porous casting. Dry and bake the mould thoroughly, also slightly smoke and warm its surface before "charging" the molten metal.

The flask may be secured as illustrated (Diag. 302).

Moulds of a serviceable form may be cut on a surface of pipeclay.

That medium is specially useful in the casting of special shapes or small ingots in the precious metals.

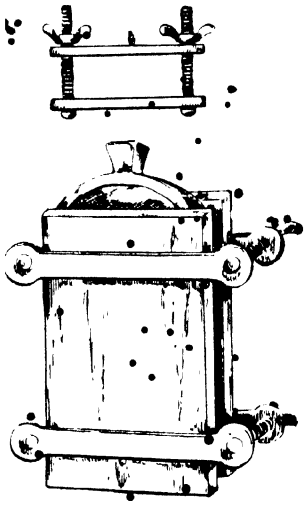
The incision may be made with a graver, afterwards drying the clay



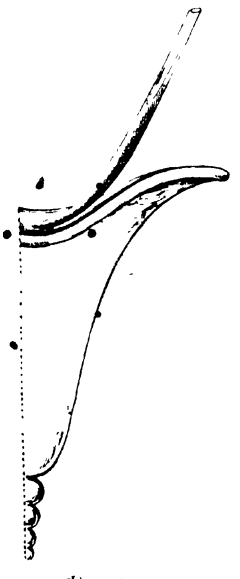
Diag. 301.

thoroughly, and binding the two cakes together, and "charging" the molten metal into the warm mould.

Retouching of Castings.—In this process great discretion is necessary to avoid overdoing the application of the punch or riffle to the detriment



Diag. 302



Diag. 303.

of the cast texture. Therefore, only retouch where absolutely required; rather allow the quality of modelling, as reflected in the cast metal, to remain intact. The file, scraper, and chasing tool will be the principal implements required.

A matting punch may be used in closing porous parts, afterwards softening the surface with deft touches from a fine riffler (Diag. 303). Any holes occurring on the metal surface must be drilled clean, plugged with a tapering wire, and soldered up or riveted.

Emery cloth may be applied in circles to smooth off the work, afterwards colouring or oxidising as desired (Chapter XXXI.).

Time and wear always add an enhanced quality of surface to cast work.

CHAPTER XXI

ENGRAVING, NIELLO, INLAYING, AND DAMASCENING

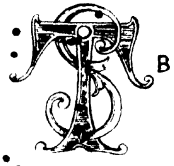
Engraving is the incising of lines upon a metal or ivory surface by the excavation of the material; the principal tools employed are gravers of various shapes and sizes.

Similar effects are possible with a sharp chasing tool and hammer.

In their application, however, the tool impressions are reflected on the obverse side of the work, whereas the graver may be directed with the utmost freedom on a thin metal, and over a delicate object, without the slightest trace of its use being left on the back of the work.

As a surface decoration it offers many possibilities if applied in simple outlining, and with judicious spacing, in marked contrast to the wriggled grounds, ivy-leaf patterns, and continuous scroll effects of commercial work.

In the study of lettering alone excellent results may be achieved; monograms, ciphers, and general inscription work providing the best practice (Diag. 304 A and B). To the enameller dexterity with the graver is indispensable, otherwise progress in champlevé enamel will be impossible.



Diag. 304 A and B.

In piercing **stencilled signs** (Diag. 85) embodying large letters or figures, the graver may be effectively applied. After being deeply incised, a few light blows from a steel hammer will readily release figures, letters, or other fretted parts.

The Tools.—For general work ten to twelve gravers (assorted) will be sufficient, with two half-round scrapers, and two threaders of varied size for shading (Diag. 305).

An **engraver's bullet** and leather pad, with an assortment of boxwood

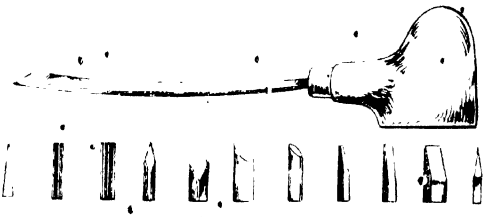
chucks to hold different types of small work, are also necessary (Diag. 306).

A small quantity of engraver's cement will be required for fixing work to the pitch bowl, as in chasing.

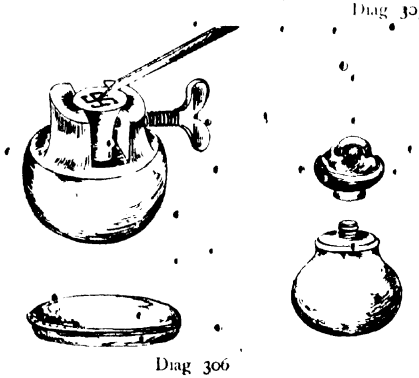
The cement may be made from the following recipe—

2 parts pitch. 2 parts plaster-of-Paris or brickdust.
1 part beeswax. 1 part tallow.

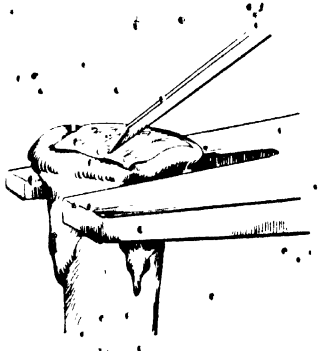
NOTE.—Mix as directed in the preparation of pitch for chasing.



Diag. 305



Diag. 306



Diag. 307

Other necessary tools are—

A cement stick (Diag. 307).
Arkansas stone (for sharpening the gravers).
Bottle Lens (Diag. 308).
Jeweller's magnifying glass.
Gamboge (lump for transferring purposes).

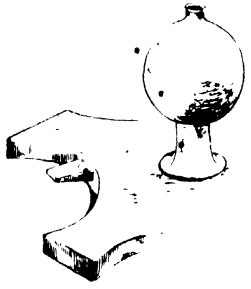
Several pieces of copper with a clean smooth face will provide the best medium for elementary practice.

NOTE.—In the sharpening of gravers, drills, cutting chisels, or scrapers, use either neatsfoot or sperm oil, with the addition of a few drops of glycerine.

The Process.—After transferring the design to the metal surface, fix it by scratching with the steel point.

If the metal is polished, dull its surface with a wash of gamboge or a few "dabs" of tallow.

If the object is small, project the graver at a perfect cutting angle,



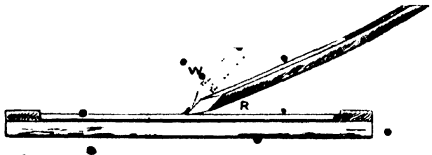
Diag. 308.

Diag. 309

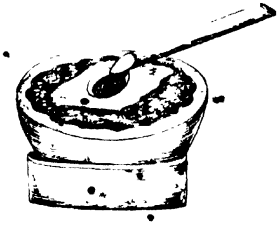
and revolve or push the work towards its point (the thumb acting as a drag or stay to its progress) (Diag. 309).

If the graver or "burin" is slightly curved in shape, a uniform and level incision will be easily attained (Diag. 310).

Avoid a line of increasing depth which is a common cause of the tool snapping at the point.



Diag. 310.—Right and Wrong Cutting Angles.



Diag. 311.

The **justifier** (Diag. 311) is nicely suited for regulating the "walls" of the cells in champlevé enamel.

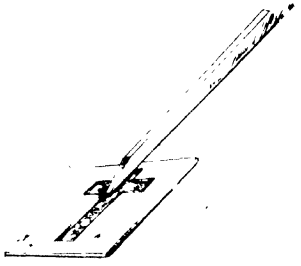
The **scorper** in various sizes is indispensable for excavating the grounds in champlevé enamel, niello, or inlay (Diag. 312).

Its zigzag action is very easily attained, and provides an effective key for the colour.

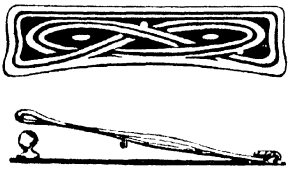
No great difficulty need be anticipated in this branch of the craft, as, with a little consistent practice, the mastery of the tools will be easily accomplished.

Niello, while not a true enamel, possesses in its preparation and application a certain similarity.

It consists of a granulated form of lead, silver, copper and sulphur,



Diag. 312.

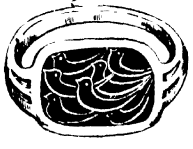


Diag. 313.—Silver Hair Clasp in Niello.

resulting when fused in an alloy capable of producing a rich, dead black.

Niello decoration is capable of strong, effective work; designs of an interlacing or stencilled treatment providing the best results (Diags. 313, 314, 315, 316).

Diag. 314.—Brooch in Niello.



Diag. 315.—Finger Ring.

Diag. 316.—Gold Watch Back (Niello).

The Metal.—Gold and silver provide suitable mediums for the work, their colours affording the necessary contrast.

In the baser metals German silver, duralumin, and aluminium, if not overheated, may be safely used.

For jewellery, use sizes 9 to 12 in gold or silver, and 20 to 22 in the baser metals.

The Composition of Niello includes silver, copper, lead, and sulphur

(antimony in a small quantity may be inserted to produce additional hardness).

Quantities—

3 parts	Silver
2 „	Copper
1 „	Lead
1 „	Antimony
Flowers of sulphur (as directed).	

Melt these ingredients (minus the sulphur) in a crucible, adding the lead and antimony after fusing the silver and copper.

Stir the molten mass with a hot iron wire spatula (Diag. 104) until thoroughly alloyed.

Discharge the ingredients into a hot ingot; afterwards reduce the casting to a granulated condition by filing with a rough file.

Intermix with this powder twice its weight of flowers of sulphur, inserting it to the crucible in small quantities, and maintaining a dull red immediately on the ingredients melting; withdraw the pot from the fire and permit it to cool.

When solidified break the crucible, and again reduce the mass to a granulated state, using the pestle and mortar for that purpose (Diag. 317).

Diag. 317.

Add to the powdered niello a slight dusting of sal-ammoniac, which, acting as a flux, will assist in its application.

The trenching of the cavities previous to inserting the niello is executed in a manner similar to the preparation of work in champlevé enamel.

The graver and scorper are the principal tools required in the work. For larger surfaces the hammer and cutting chisel may be introduced.

Carefully key the incised cells as illustrated (Diag. 318), which will supply the necessary security to the niello after firing.

Diag. 318

Application and Firing. Clean the metal thoroughly with pumice powder or ground bathbrick, and in large trenches apply a slight dusting of sal-ammoniac powder or borax.

If fine line and intricate detail predominate, it will be advisable to spread the niello over the entire surface.

Vessels in the round will be treated in a similar manner, afterwards concentrating the heat with a clean flame, preferably from underneath the work, and "pouncing" in additional powder as required.

Guard against overheating the medium, which would affect its surface and prove detrimental to the precious metals. The clean flame from a spirit lamp or charcoal fire will provide the best results.

Attain a uniform surface mainly by the careful application of heat. After the first fusing, clean off all surplus niello by the aid of an old smooth file. This implement is less liable to clog, or tear the gritty medium from the cavities.

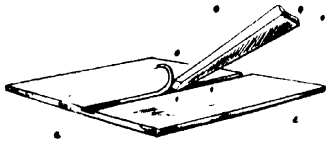
After removing the "rough" of the niello, take a smooth hot spatula, and with an occasional dip into a tallow candle carefully burnish the surface of the decoration.

This method will solidify the medium, and generally level the entire surface.

The water-of-Ayr stone may now be applied with a little water; afterwards use a smooth hand buff with crocus and oil, applying it with a revolving action.

The surface of the hand, for giving a final polish, is unequalled.

Simple inlaying embraces the beating and burnishing of a previously annealed metal into an engraved, cast, or die-struck cavity.



Diag. 319.

The inserted medium is usually in the form of a wire, and the cavity slightly undercut (Diag. 319), which acts as a key in retaining the inlay.

Various schemes of colour are possible; the process affording unique opportunities for experimental work

Fine gold wire may be wrought into a surface of mild steel, or pewter applied to a plate of brass.

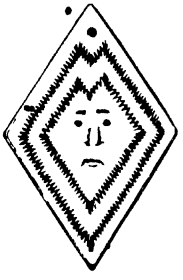
With the introduction of solder other adaptations are possible, and all fusible alloys may be inserted in a similar fashion.

In soldered inlays undercutting will be unnecessary, as the finest outline may be flooded with metal, and the surplus medium carefully removed with a smooth file and finally polished (Diag. 320).

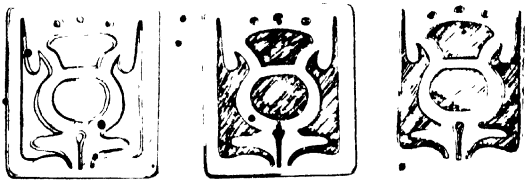
Pierced inlays are fretted with the piercing saw (Diag. 321); afterwards an equal shape of a different metal is soldered into the resulting cavity.

The surface may be levelled with a smooth file, stoned, and polished.

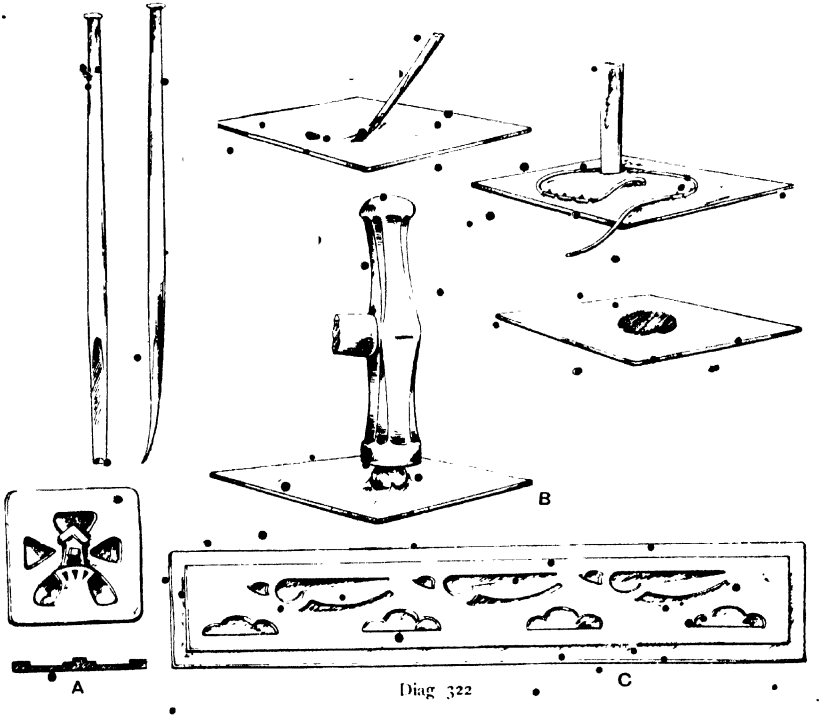
If copper is used, oxidising may be employed to heighten the effect (see Chapter XXXI.).



Diag. 320



Diag. 321



Diag 322

Overlays of pierced metal will prove equally effective. Diag. 322 illustrates a soldered overlay, A; a riveted overlay, B; and pierced overlay, C.

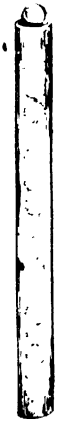
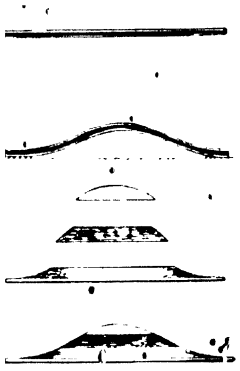


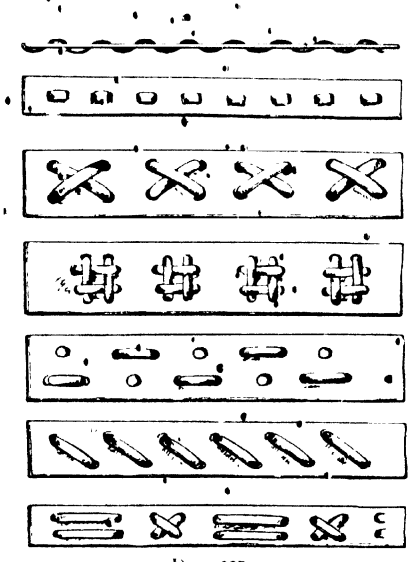
Fig. 323.

Fig. 324.



Diag. 325

Diag. 326.



Diag. 327.

Alloys of various metals may also be employed as in the work of the Japanese craftsmen. For example, a tubular wire of silver (Diag. 323) may be filled alternately with beads of copper and brass; if passed through the rollers, or slightly hammered, the beads will become locked. A light application of a smooth file on the flattened surface of the tube will produce an effect similar to Diag. 324, with the addition of the varying colour of the enclosed metal.

If the beads are inserted with a pallion of solder, greater solidity will be attained.

Sheet metal may be adapted in a similar manner by soldering thin layers of different metals together, afterwards rolling or hammering them to a uniform surface. Sections in repousse may be applied to the combined alloys, and filed level or cut with the graver, to expose their varying colours (Diag. 325).

Wire may be treated in a similar manner, by compound twisting and the use of solder (Diag. 326).

Pierced borders may also have alternate interlacing straps of metal applied to their surface (Diag. 327).

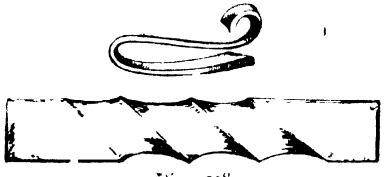
CHAPTER XXII

ENAMELLING

Introductory.—The term "enamel" is directed generally to all vitreous substances (of numerous and varying compositions) fused with the application of heat upon different bases, those usually employed being suitable metals.

Enamel in its original state is practically colourless; its bases are silica, soda, or potash, with the addition of lead oxide to give plasticity to the fused medium.

Lead and potash heighten the colour, but increase the softness of the enamel. To fully appreciate this property, hold a narrow strip of common glass immediately above a gas jet, when it will readily become plastic, and may be bent or twisted to various forms (Diag. 328).



Diag. 328

The clear flux is further intensified by melting and alloying with its molten mass various metallic oxides, which give distinctive colour to the resulting product.

Red and purple are obtained from the use of the "precious metals"; iron oxide and copper oxide produce other tints of red.

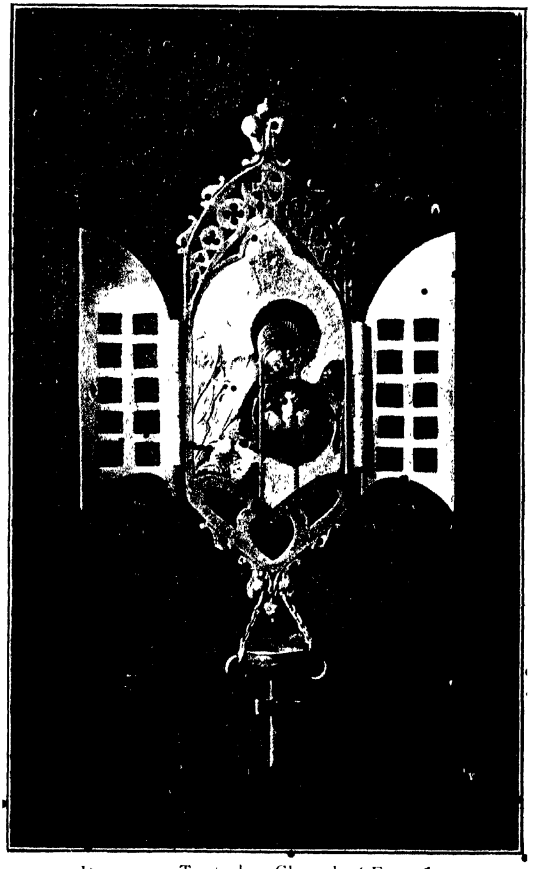
Antimony oxide with the addition of certain quantities of lead and sal-ammoniac gives a yellow; manganese gives a shade of violet.

Turquoise blue is obtained by the use of copper scale; a green results from copper peroxide; the cobalt salts with various other ingredients will give different shades of blue.

Lustred effects are obtainable on gold, silver, and copper. Crimsons, blues, and greens are intensified by the insertion of metallic foils, over which a protective layer of clear crystal, or other translucent enamel, should be fused.

The insertion of foils impart a beauty in tint, with an iridescence unattainable by any other method.

The art itself, while affording infinite variations in colour and surface



Diag. 329.—Triptych in Champlevé Enamel.
Designed and Executed by the Author.

effect, is more or less the expression of certain recognised styles, peculiar to the work of different nations, and different periods in the evolution of the craft.

To successfully practise the art, an intelligent knowledge of the different processes entailed in decorative metal work is indispensable, otherwise progress will be slow and disappointing.

Future study is solely directed to the separate styles, and their varied technical treatment.

The Styles—

Champlevé enamel.
Cloisonné enamel.
Plique à jour enamel.
Basse taille enamel.
Limoges enamel.

Diagr 330.—Silver Pendant in Cloisonné Enamel. (Student's work.)

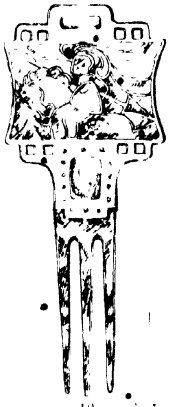
Champlevé Enamel, in its simplest form, is the inlaying of a sunk cavity (previously cut with the graver or chisel, cast, bitten with acid, or produced from a die) with ground enamel, which is fused in the kiln (Diag. 329).

This style is admirably suited for beginners, on account of its simple and straightforward application, while a previous use of the graver and cutting chisel will ensure rapid progress in the work.

Cloisonné enamel (Diag. 330) is so called as a result of the design

being built with a framework of cloisons, or partitions in wire, which form the vertical walls of a "cell," and serve to hold the enamel like the metal outlines in champlevé enamel. The Japanese are masters in this style: their productions on the round are well-nigh technically perfect.

It is sometimes called Byzantine enamel, owing to the preference shown for this style by members of that school.



Diag. 331.—Plique à jour Enamel.

Diag. 332.—Basse-taille Enamel.

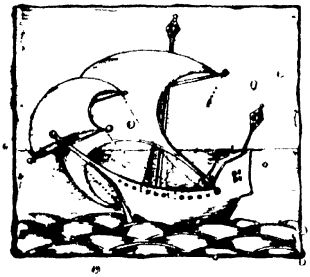
Diag. 333.—Images of Painted Enamel.

Plique à jour Enamel.—This style gives an absolutely transparent rendering of the medium, with the outlines of the design like a filigree (Diag. 331).

Placed towards the light, its effect is similar to stained and leaded glass. To ensure success, great care and delicacy must be exercised in the handling of the materials, while its ultimate strength is largely dependent upon the correct "locking" and "keying" of the metal tracery.

Bassetaille in many respects resembles die-cutting, either in concave or convex section. The cavities, as in champlevé, are cut with the graver and chisel; afterwards the ground transparent enamel is flooded in, fired, and refired until a uniform surface is attained (Diag. 332). This style is productive of many beautiful shadow effects.

Limoges or Painted Enamel (Diag. 333) is practically a picture in enamel treated decoratively, and independent of a retaining border of metal. Its possibilities embrace all the aspiring craftsman might hope to achieve in the art. Pursued on traditional or experimental lines it will provide a fertile study. The style, truly applied, should be a creation "born of the fire," its inherent effect quiet and soothing, or glistening and scintillating as a hidden jewel, according to the cunning application and firing of the enamels.



Diag. 334 Coated Enamel

Coated or Surface Enamel, while unworthy of classification as a separate style, possesses certain exclusive treatments of a distinct nature. Figures and similar objects are mainly executed in this style, the enamel being held with small pecks of metal, obtained by "flinking" with the graver or cutting chisel (Diag. 334). Chasings, die-work, and castings are usually executed in this style, in a manner similar to the glazing of pottery, and suggestive of painted enamel in an elementary form.

CHAPTER XXIII

ENAMELLING—TOOLS AND MATERIAL

The Necessary Tools and other Requisites demand first consideration before commencing practical work in the craft.

As in the repoussé, silversmithing, and jewellery branches, well-appointed lists are provided by the trade firms to meet the requirements of an individual student or equip the school or craftroom.

However in the art of enamelling, certain requisites call for special consideration to ensure their correct choice, position, and adaptation.

The Bench of the "island" type (provided it is well lit with an overhead light) will admit of the greatest freedom and access. All vibration must be reduced to a minimum. A small tool rack may be fixed conveniently on its surface to carry the various light accessories of the craft.

An adjacent covered shelf (to exclude dust) will serve as a suitable position for retaining the various stoppered bottles, saucers, etc., which contain ground enamel. Keep the enamel bench in perfect order, and scrupulously clean.

The acids, pickles, etc., must be kept on a separate table or shelf, and in the most direct position to allow the escape of obnoxious fumes.

The Enamel Kiln, or muffle furnace, is the most important item of the enameller's list, and in its choice great discretion must be exercised to obtain the best medium size, combined with quick firing, and uniform heat.

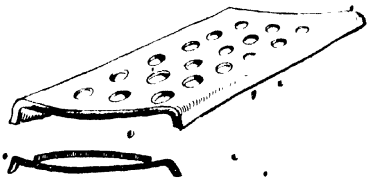
The principal muffles are the electric, gas, oil, and coke; however, for all general purposes, including annealing and melting, the gas muffle is most worthy of recommendation. A 7-inch by 5-inch will be found a serviceable size.

A Crucible with a fireclay door placed over a gas-ring may be utilised for small work with good results; while the concentrated flame of the gas blow-pipe will prove equally effective, allowing the flame is not in

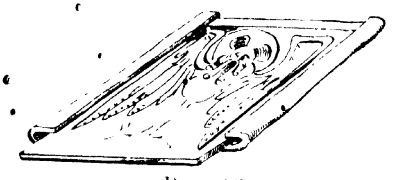
direct contact with the enamel. Always protect the eyes with a sheet of mica, or movable glass screen, when examining the work in the kiln.

Metal Cradles of nickel, mica, or sheet iron will be required as a support for the work during the process of firing. The nickel plates are preferable owing to their clean surface and freedom from scaling

The sheet-iron supports, if used, must have a thin even covering of plaster-of-Paris, pipeclay, or powdered fireclay, combined with a small



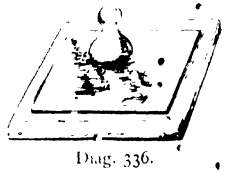
Diag. 335A



Diag. 335B.

quantity of alum to prevent the surface "giving" on the application of heat. They will, when coated, be fully $\frac{1}{16}$ of an inch in thickness, oblong or round in shape, and concave in section, which will prevent the enamel (if flat) from adhering to the cradle, and admit the free use of the tongs. Greater uniformity of heat will be maintained if perforations are spaced equally throughout the surface of the metal rest (Diags. 335A and 335B).

A Mortar of Wedgwood Ware and a Porcelain Pestle are indispensable in the grinding of the enamel, while a smaller size of agate will be useful for finer work (Diag. 317).



Diag. 336.

A Ground Glass Slab and Mullar may also be added to the list (Diag. 336).

Many smaller requisites will be required in the practice of the craft, including the enamels, acids, metals, etc.

The Enamels are of varying degree, some hard, others soft and easily fired, therefore the student must become familiar with the colours, or disappointing results will inevitably follow. For beginners, at least, it will be wiser to adhere to one manufacturer's enamels.

In firing successive layers, the harder colours, which require greater heat, must be applied first, and the softer enamels latterly with a careful and modified firing.

A reference book should be kept by each student, wherein various

notes relating to the firing and general colour combinations could be retained. By this method results may be anticipated previous to firing, and colour schemes clearly worked out.

The lump enamel is supplied as desired by the ounce or half-ounce, and for reference should have a gummed label attached with a concise note of its colour, etc.

Transparent and opaque enamels may be easily distinguished by holding these mediums towards the light.

The Metals used for Enamelling are fine gold, pure silver, copper, gilding metal, bull metal, sheet iron. Gold, silver, and copper are the best metals for the process; the gold not less than 18 carat; the silver preferably above standard; copper (Swiss) or as fine as possible with the minimum alloy of zinc. The copper is a perfect medium for beginners, owing to its marvellous durability, which numerous refirings will not destroy, allowing the metal is not actually burned.

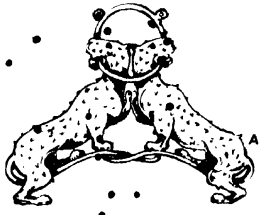
If an error occur in the application of the colour, the fused medium may be chipped from the copper, which may be recharged, and refired without materially affecting this useful metal.

Gilding metal, or fine bronze, with its inherent rich tone, is an alloy of copper and tin. Enhanced colour effects are obtainable on its surface, as compared with a similar treatment on copper.

Bull metal and similar alloys of bronze contain a preponderance of copper.

Sheet iron and mild steel with a special preparation (see Chapter XXIV.) will successfully retain certain colours, principally opaque.

Its varied possibilities may be fully appreciated by referring to the numerous examples of commercial advertising signs, also the perfect surfaces obtained on our domestic ware.



Diag. 337.

Castings in silver and bronze, if enamelled, must undergo a preparation of "planishing" with the chaser's punch to close the pores, and "flinking" with the cutting chisel or graver to retain the enamel (Diag. 337).

Electrotypes, if enamelled, must receive a similar preparation.

Enamels fused on electrotypes or castings are never so durable or clear in colour as when fired over the purer metal.

Flat surfaces, if cast, will require to be specially "keyed" as illustrated (Diag. 337).

The under-cut section, A, towards the outline furnishes a grip to the delicate enamel.

Tiny "pecks" or "grafts" with the graver or cutting chisel, as illustrated, will also provide a useful key.

Brass, German Silver, and kindred alloys, or other metals of a low melting point, are entirely unsuitable for enamelling.

The solders used on enamelled work must necessarily be hard to effectively withstand the heat of the kiln; while the seams, or soldered points of contact, must be protected with loam (moulding sand) or preferably jeweller's rouge (which is finer) mixed to the consistency of a paste with water (Diag. 338).

Diag. 338

Gold solder of 9-carat grade will prove the most reliable medium for the process.

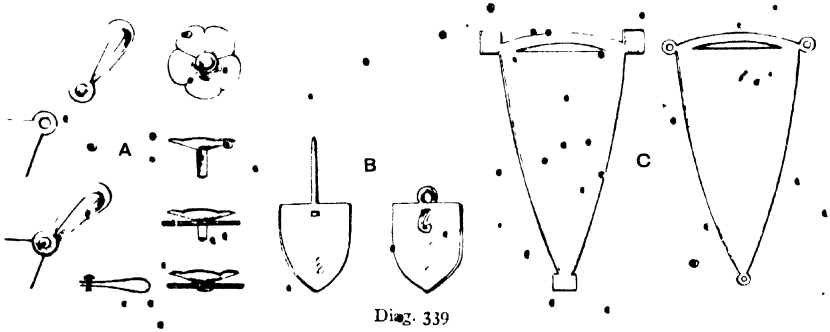
Its use will ensure sound joints and purity of colour after firing the enamel, in marked contrast to the dark stains prevalent with the use of the ordinary silver solder.

If combining pure gold, use 18-carat wire as the solder.

Avoid any excess in the use of the solder, which will ensure a cleaner surface for the enamel.

Surplus solder may easily be cleaned off with the graver.

Avoidance of Solder.—If a little forethought and attention were directed to the constructional work in metal previous to preparation for



Diag. 339

the enamel, many solderings could be omitted, thus ensuring perfect safety while in the kiln, also permitting greater liberty to be taken with the scheme of work.

Diag. 339 A, B, and C, will convey several methods to supplant

the use of solder, *i.e.* with the rivet A, the interlocking joint B, and the piercing saw C.

Solders for the Enameller.

For general work—

	Ozs.	Dwts.	Grs.
Pure Gold	1	0	0
„ Silver	1	0	0
„ Copper (Swiss)	0	10	0
Quantity of the average silver solder	0	8	0
Oz.	2	18	0

For transparent enamel—

	Ozs.	Dwts.	Grs.
Pure Gold	1	0	0
„ Silver	0	14	0
„ Copper (Swiss)	0	7	0
Oz.	2	1	0

CHAPTER XXIV

PREPARATION AND CLEANING OF THE METAL

Previous to enamelling, the metal must be annealed and chemically cleaned of all deleterious matter.

This process is similar to the method employed in Chapter VII., with this exception, that a greater degree of cleanliness is imperative, attained by the use of additional acids, pickles, and other chemicals, according to the requirements of different metals. Various compounds and implements are employed for cleansing metallic surfaces before inserting the ground enamel.

The principal agents are nitric acid, sulphuric acid, the cut of the graver, cutting chisel, and scraper, also hot diluted caustic soda, and methylated spirit.

THE "PICKLES."

Nitric Acid Pickle—

1 part of nitric acid.
6 to 7 parts water.

Sulphuric Acid Pickle—

1 part of sulphuric acid.
8 or 9 parts water.

NOTE.—In preparing the "pickles" add the acids to the water.

Gold will be cleaned by carefully annealing and allowing it to cool, It is then placed in a porcelain "boiling out" pan containing a quantity of the nitric pickle, and brought to boiling point, when a clean, yellow surface will result.

The parts intended for the enamel must now be scratched and brightened by scouring with a clean, hard brush and powdered pumice.

Any suspicion of grease may be removed with soda and water,

combined with several drops of ammonia. Afterwards immerse the metal in a bowl of clean water until ready to "flood in" the ground enamel. If the gold has been directly cut with the graver or chisel, do not lose the glistening lustre by annealing or inserting it in the pickle.

Transparent enamel always emits greater brilliancy over a newly incised surface.

In removing the work from the various "pickles," use either a wooden spatula or glass tongs.

Steel pliers or tongs should be avoided in consequence of the objectionable oxide which they produce upon the metal surface.

The use of the porcelain pan is preferable to the copper vessel for work in enamel.

Silver, after being annealed and permitted to cool, may be brought to a pure white colour by boiling out in the sulphuric pickle. Afterwards scour it with the brush and powdered pumice, etc., as in the case of gold. It may also be quenched direct and cleaned in the cold sulphuric pickle, but a longer time must be allowed for the action on the metal surface.

Gold may also be cleaned in the sulphuric pickle.

Copper of all grades oxidises readily; this condition is particularly noticeable after annealing or enamelling, when it casts off a decided black scale.

In preparing its surface for the enamel, it is immersed in a bath of 1 part nitric acid, and 2 or 3 parts water.

This treatment will produce a glistening red hue on the surface of copper. Any surplus residue may be removed by scouring with a brush and powdered pumice.

A thin film of clean moistened borax applied over the unenamelled parts will produce, on attaining a certain temperature, a protective coating of borax glass, which will lessen the oxidisation and prevent spurting of minute black spots over the molten enamel.

Apply the borax carefully to prevent any of that medium coming into contact with the enamel.

Sheet Iron demands an exclusive preparation to eradicate the scale which is prevalent on its surface, also a specially prepared flux.

In its early stages it is pickled in a solution of 1 part nitric acid or hydrofluoric acid to 6 parts of water, which effectively removes the scales. A final scrubbing is then directed over its surface with a wire brush and sand to render it even and bright.

Its first coat of enamel results in a dull, bluey grey, and on this base the other colours which are exclusively opaque are graduated.

NOTE.—In cleaning and pickling objects in enamel, a shallow porcelain tray with projecting lip as a pour will provide the most serviceable utensil.

Cleaning the Metal with the Graver.—Parts intended for enamelling on any metal may be effectively cleaned with the fresh cut of the graver or chisel, independent of chemical application.

Diag 340.

Grounds or cells intended for colour, if treated in the above manner, always ensure a greater reflective power.

This effect is intensified if the engraved surface is wrought to a convex section (Diag. 340).

After cutting, immerse the work immediately in a vessel of clean water to prevent oxidisation.

CHAPTER XXV

PREPARATION OF THE ENAMEL

The grinding and washing of the lump enamel will be accomplished by the aid of a pestle and mortar, combined with an efficient supply of water.

The raw material, if moderate in size, may be easily broken with a few blows from a steel hammer.

Larger pieces, on the application of heat and sudden quenching, will readily crumble under pressure of the pestle. Before commencing the work estimate the quantity required, avoiding surplus, as freshly ground enamel is always preferable. Thus the majority of lump enamels are more satisfactory and economical than the powdered medium.

When grinding, immerse the lump enamel in sufficient water to prevent the chips "flying" during the process of pounding with the pestle. The mortar may be rested on the sand-pad, which will reduce the vibration. Apply the pestle, firmly held in the right hand, with the elbow close to the side, which will admit of greater pressure.

Continue with a regular rotating action until the lump enamel is reduced to a coarse sand.

During this process the water will assume a milky hue; strain this milk away and continue washing and straining until all residue is removed and the liquid perfectly clear.

In general practice, apply the enamel as coarse as permissible; this condition tends to greater brilliancy when fired. Fine sand is about the correct consistency of the medium after cleaning.

In grinding opaque enamels the necessity for washing is not so important, but always reduce opaque enamels to a *fine* powder.

Ground Enamel may be retained with a small quantity of water in wide-mouthed bottles with cork stoppers. They are specially adapted for the removal of the enamel with a palette knife (Diag. 31).

A gummed label attached to the bottle with particulars regarding the enclosed enamel, would on future occasion simplify the work

In retaining enamels for lengthened periods, keep them in a dry, powdered condition; if kept moist they are liable to deteriorate.

Before application to the metal surface, transparent enamels may have a few drops of nitric acid, or cyanide of potassium solution added to the final washings.

Dig. 341

Surplus Enamels of various colours should not be discarded, but collected in a wide-mouthed bottle as a "backing" for the obverse side of future work.

Finely-ground Enamel will be obtained by the use of the agate pestle and mortar, or by being reduced upon the ground glass slab, with the small mullar.

As the finely ground medium is principally used as a paint for tinting purposes, a few drops of fine oil of lavender may be added after grinding, to ensure a free manipulation of the colour.

A minimum quantity of fat oil of turpentine may also be used, but any excess of residue would prove hurtful to the strength of fine outlines.

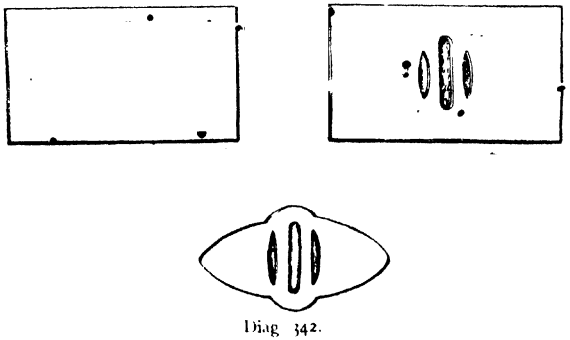
CHAPTER XXVI

CHAMPLEVÉ ENAMEL.

Practical work in champlevé enamel for the young student must embrace a simple and direct pattern, without (Diag. 342) unnecessary detail, or the exacting work with the graver and cutting chisel may become monotonous.

The metals employed must be of a fair weight; if in gold or silver sizes 10 to 14, sheet metal gauge, and if in the baser metal sizes 18 to 20, Birmingham wire gauge.

The above thicknesses are equal to that of the average penny.



Diag. 342.

Anneal and clean the metal; afterwards transfer the design to its surface with a clean scratched line.

Fix the metal on the engraver's cement stick (if small) (Diag. 307), or on the chaser's pitch bowl (if large) (Diag. 23).

With the lozenge-shaped graver (Diag. 311), apply a clean incised outline, following the previously scratched pattern to a uniform depth of $\frac{1}{20}$ to $\frac{1}{40}$ part of an inch. Carefully observe in Diag. 310 A and B the right and wrong cutting angles of the graver.

Unless the use of the graver is mastered progress in champlevé enamel must necessarily be slow. Therefore, for beginners at least, a convenient piece of soft copper for preliminary practice with the graver and scorper will prove most helpful.

Diag. 343

With the incised outlining complete, apply the scorper (Diag. 312), using it at varying angles until a well "keyed" surface and regular depth are attained. A "squeeze" with chaser's wax or modelling clay will clearly depict its relative heights (Diag. 192)

The Sharp-cutting Chisel and Hammer must be used in the above process if the work is of large dimensions Even in smaller sections it may be employed with advantage in paring and roughing out the main surface of metal (Diag. 343).

Diag. 344.

Its use in the early stages of champleve is preferable to the tedious, and somewhat slow work of the scorper.

Observe Diag. 343 where the correct working angle of the chisel is shown. After the bulk of metal is cut away, the final levelling will be accomplished with the scorper. If using opaque enamels, an absolutely uniform surface is not essential; but with the transparent medium, badly engraved grounds are magnified. The sharp dotting punch will also provide a reliable ground (Diag. 344).

Diag. 345 will convey several possibilities for the treatment of grounds in champlevé enamel.

The Justifier or Bullsticker (Diag. 311) will now be utilised for repairing and trueing all irregularities on the "walls" of the "cells" previous to the insertion of the ground enamel.

The obverse side of the metal must also receive a slight "tooling" with the scorper (to retain the enamel) directly behind the sections already incised (Diag. 346).

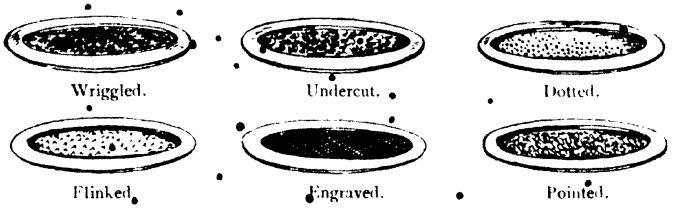
This process is most important to ensure an equal contraction and expansion of the metal and enamel, otherwise the uneven shrinkage would result in the brittle enamel "sparking" off on most unexpected occasions.

Finishing and repairing the metal surface before the application of the enamel is a most necessary process, although many times neglected.

The slips of the graver, or other blemishes, will easily be effaced by the use of the smooth file, scraper, water-of-Ayr stone, and hand-buff

After obtaining a passable surface, chemically clean the metal immediately after the finishing, as directed in Chapter XXIV., and grind the enamel as already described.

After grinding and washing, "flood in" the moist enamel with a small



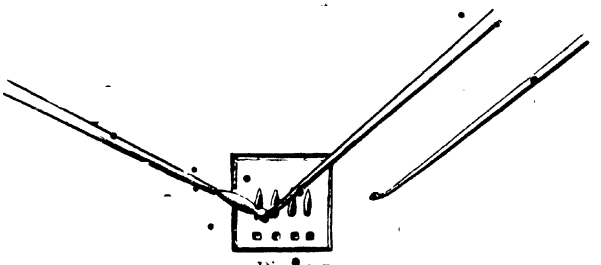
Diag. 345.

camel-hair pencil, or spatula of wood or metal (nickel-plated) which is practically rust resisting (Diag. 347).

If the cells are extremely fine, the spatula will be the better instrument.

Diag. 346

Should the cells be large and open, a few drops of prepared gum tragacanth added to the moist and ground enamel will act as an additional fixitive. The fine camel-hair brush slightly damp will, if applied, remove every speck of surplus enamel remaining on the surrounding strap-work. This surface cleaning before firing is most necessary, especially on copper, to ensure clean and uniform outlines of enamel.



Diag. 347.

Narrow strips of white blotting-paper must now be lightly applied at the edges of the cells to suck off all remaining moisture.

Large surfaces of unfired enamel may be levelled and pressed in with a small palette knife. However, it is advisable to keep the medium

slightly full, which will counteract the "sagging" of the enamel during firing. Avoid irregular thicknesses of the enamel; thin and evenly applied enamels are always the most successful.

The firing of the enamel entails several preliminary operations demanding delicate touch and care.

With a large-sized palette knife place the enamel (well-centred) on a nickel or sheet iron cradle, preparatory to steaming off all remaining dampness; all solderings must be protected with a paste of loam, rouge, or whiting. Large surfaces of metal, to prevent "sagging," may be "bedded" on fine whiting, or in a plaster-of-Paris mould.

A small drying chamber free from dust may be arranged immediately above the enamel kiln. However, with ordinary care, this drying may be accomplished by placing the work in front of the open furnace.

Long charging tongs, with sharp tapering nose (Diag. 348), will be found most desirable in the removal of the enamel.

Dry the enamel thoroughly before firing; if damp, the surface will be disturbed with the "spurting" of the medium.

Diag. 348.

As quick firings are preferable for the *first firing* in transparent enamel, have the kiln at full heat.

Watch it carefully during this important process, until the dull, opaque, unfired surface gives way to a molten, glistening sheen, capable of reflecting the large palette knife if held over its surface.

Carefully withdraw the enamel, and permit it to cool gradually in a warm atmosphere.

When perfectly cold, examine the work and arrange for subsequent firings.

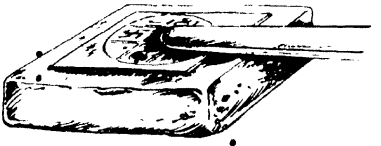
If copper, first clean off the scale by insertion in the nitric acid pickle, afterwards scouring the metal with a brush and ground pumice; if silver or gold, it may be inserted in a porcelain dish of cold sulphuric pickle and gradually brought to boiling point.

Remove the enamel with a wooden spatula or glass tongs, and permit it to cool before finally washing out the water.

All inequalities of surface and minor defects can now be remedied, also the cells recharged with the various colours.

In refiring avoid a cold surface, but place the work with the palette knife on a prepared hot cradle, which will ensure a direct and rapid firing.

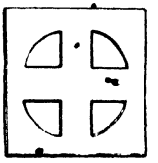
Any holes must be picked out with the point of a graver and the corundum file, and afterwards washed with a small quantity of hydro-fluoric acid. Use great care with this acid, and retain it in the gutta-percha-covered bottle as supplied.



Diag. 349.

Its action will effectually clean out all discoloured matter or residue resulting from the corundum stone.

During the grinding with the corundum, or cleaning with the graver, rest the enamel on a pad of cork or rubber, which will relieve the pressure and lessen the danger of straining the enamel (Diag. 349). After a thorough cleansing in running water, and with the final firing, apply a thin film of clear crystal, which will produce greater liquidity in the underlying colours.



Champlevé Enamel may also be prepared by piercing the cells with a fretsaw and soldering or riveting a ground of metal to the obverse side of the object (Diag. 350).

For small panels this method will be found quick and effective.

Diag. 350

A Matted or Egg-shell Texture may be given to the enamel surface in preference to the prevailing glaze.

This is attained by stoning the enamel to a level with fine corundum and water, pumice, and finally with a smooth water-of-Ayr stone.

Apply the last process with a circular action, which will result in more perfect uniformity of texture.

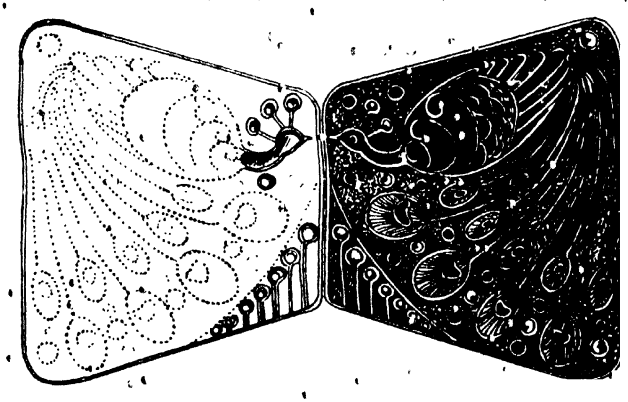
The metal strap-work surrounding the champlevé enamel may be oxidised with an application of warm ammonium sulphide, or it may be silver-plated or partial gilt.

If any variations are apparent in the surrounding walls of metal, a few quiet and simple lines with the graver will minimise this defect.

CHAPTER XXVII

CLOISONNÉ ENAMEL

Cloisonné Enamel consists in the outlining of the design with thin, narrow bands, or threads of metal to hold the enamel, to which the use of various metallic foils, cunningly inserted throughout the grounds, conveys a jewelled effect (Diag. 351). Its practice is extremely fascinating, and the style is admirably suited for the precious metals, less weight being required than with similar work in champlevé enamel.



Diag. 351.

Material required. The metals will be of a comparatively thin nature, owing to the inserted cloisons, combined with the enamel, adding weight and strength to the work.

An average size in gold and silver is 6 or 7, metal gauge; in copper, size 25 or 26, B.W.G.

The Bands of Wire are procurable in gold, gilding metal, silver, or

copper of oblong section, and about $\frac{1}{32}$ of an inch wide. In thickness, the wire is equal to ordinary writing paper. Many variations of these bands are possible in simple or compound plaits.

Keep the Cloisonné Wire in good condition by winding it (after annealing) tightly and flatly on a wooden reel.

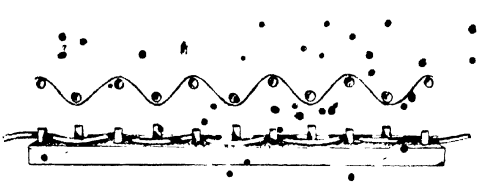
If in "kinks" or out of shape, it may be regulated by lacing alternately round several nails or stout pins securely fixed in the bench, as illustrated (Diag. 352).

Model the cloisonné wire with the round-nosed pliers and tweezers to the exact outline of the design (Diag. 353).

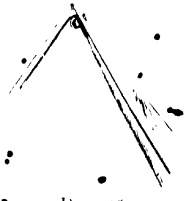
Cut the various details with a cutting chisel, resting the wire on a piece of sheet brass or German silver.

If cut with the shears the wire will lose its shape, and give greater difficulty in mitring.

Cloisons of the same form, if repeated several times, may be easily



Diag. 352



Diag. 353

attained by securely fixing pins on the design at the exact points of contact, and bending the soft wire to the exact outline (Diag. 354).

The Sheet Metal must now receive a corresponding rim to enclose the cloisons and strengthen the work.

If the panel is square or oblong in shape, the edge may be easily wrought up on a bick iron (Diag. 355).

If round, it will require a half-crescent tool or a small hammer head fixed in the vice (Diag. 356).

During the formation of the edge, work to a narrow guide line, drawn with the steel dividers.

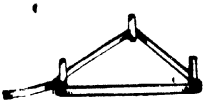
Placing the Cloisons. With the wires bent to shape, and the metal disc complete and chemically clean, arrange the cloisons to the exact form of the design over a previously scratched outline (Diag. 357).

Solder may be used for fixing, but mainly on round vessels or irregular surfaces.

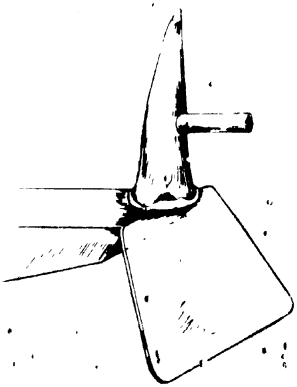
Other substitutes are "glaire" (white of an egg), rice paste, or thin

gum. However, on fairly uniform surfaces a light sprinkling of flux (carefully applied) will be found a reliable fixitive.

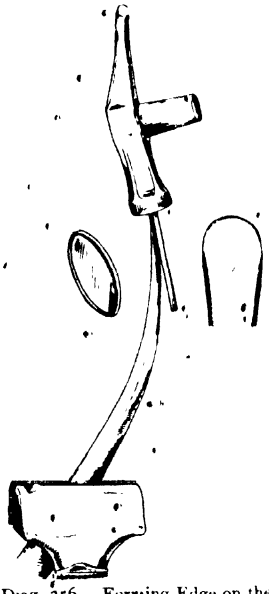
The Flux after grinding must be thoroughly dried, and with a small quantity on the end of a palette knife, gently vibrated evenly and thinly throughout the cloisons. Remove the work with great care to



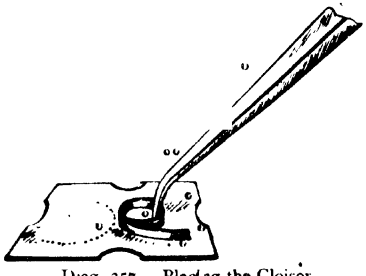
Diag. 354.



Diag 355.—Forming edge of panel on the Beck Iron.



Diag. 356.—Forming Edge on the Crescent Stake



Diag. 357.—Placing the Cloisor.

avoid disturbing the wires, and apply a quick firing. This will effectively secure the cloisons in position, and simplify the completion of the work.

The Powdered Flux may be sifted from a small perforated metal box if desired.

Solder, if utilised, must be as pure as possible, gold solder being preferable.

Objects in the Round with cloisonné decoration must either be

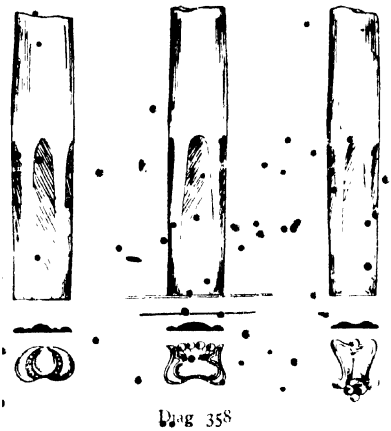
wrought from the flat circle or constructed with a lap joint (Diag. 142), otherwise the soldered seam is liable to give way in the kiln.

Round Vessels must have an interior coating of enamel; counter-enamelling must be applied to all panels, etc., to provide equal expansion and contraction of the different mediums.

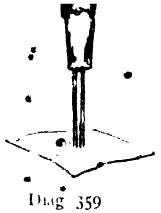
Gold, Silver, or Platinum Foils may be used with telling effect throughout the various styles of enamel.

Different designs and devices may be executed in flat or bas relief on foil surfaces: circles of varied size may be pierced out of foil or thin sheet gold with a perloir

Impressions may also be obtained with 'blind tooling" on the thin



Diag. 358



Diag. 359

and susceptible foil while resting on a flat pad of cork or leather (Diag. 358).

Irregular shapes may be cut out on the foil by inserting it between two layers of "stamp edgings," and carefully drawing the desired pattern on the paper surface, afterwards cutting out the shape with a pair of scissors or a sharp penknife. The foil will easily be released by floating the paper and foil (combined) in a saucer of water until they separate, having previously pricked holes through paper and foil with the pouncing needle.

Place the foil on the enamel surface with a little gum tragacanth applied with a small brush to its under side.

Prevent the accumulation of air during the firing by pricking its

surface from behind with the **pouncing needles** (Diag. 359); also give the foil a slight fulness, which will emphasise its brilliancy.

Before firing, dry it carefully, or the medium will be liable to spring off.

A slight firing will be sufficient to fix it, using a small palette knife as a spatula to press it down slightly (if required) on removing it from the kiln.

After cooling, diffuse a delicate film of translucent enamel over the foil, and avoid hard edges by careful blending of the colours.

When the enamel is level with the cloisons and successfully fired, clean and grind its surface to a uniform level, using the fine corundum file, lump pumice, and smooth water-of-Ayr stone with a little water.

Proceed carefully with this work, as a coarse or hurried treatment might injure the delicate enamel.

The work, after stoning and cleaning, may again be fired to produce a smooth, liquid finish; or it may be hand finished with crocus powder or rouge applied with a hand buff (a strip of felt or chamois leather glued to a narrow length of wood).

A little oil in conjunction with the powder will assist its application.

Bright and dull sections may be introduced throughout the enamel surface with acids, or they may be "picked" out with a small water-of-Ayr pencil.

The cloisons or wires may be finally gilt, plated with silver, oxidised, or given a bright finish.

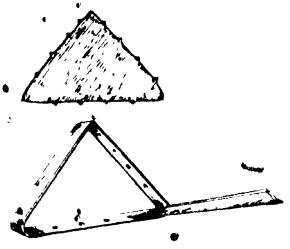
CHAPTER XXVIII

PLIQUE A JOUR ENAMEL

Its Principal Features.—Plique a jour enamel is probably the most delicate of all the styles.

It consists in the production of a filigree in wire or pierced metal. The resulting cavities are then filled with ground enamel and fired.

Successful results can only be obtained by a correct and careful manipulation of the metal and enamel.



Diag. 360.

The metal must not be less than sizes 10 or 12 in gold and silver, sheet metal gauge, and sizes 19 or 20 in copper, B.W.G.

Keying the enamel is the most important part of the process.

After fretting the design with the piercing saw, and trimming all irregularities of outline, take a sharp graver and "flink" the centre of the perforations (Diag. 360).

These small incisions act as a key in holding the delicate enamel.

If the design is executed in filigree wire, this should first be slightly hollowed (Diag. 361).

Wires of gold, platinum, silver, and copper may be used as a filigree.

Soldering of the filigree may be easily accomplished if the wires are previously bent to shape, grouped and slightly imbedded on a perfectly level surface of chaser's wax or modelling clay (Diag. 362).

Diag. 361.

A mould in plaster is taken off the wax. After the plaster is perfectly set, carefully withdraw the wax without disturbing the filigree. The mould, with the fixed and projecting wires, after being thoroughly baked, must have all the surplus plaster cleared from its surface (Diag. 363).

A small quantity of alum added to the plaster will harden its

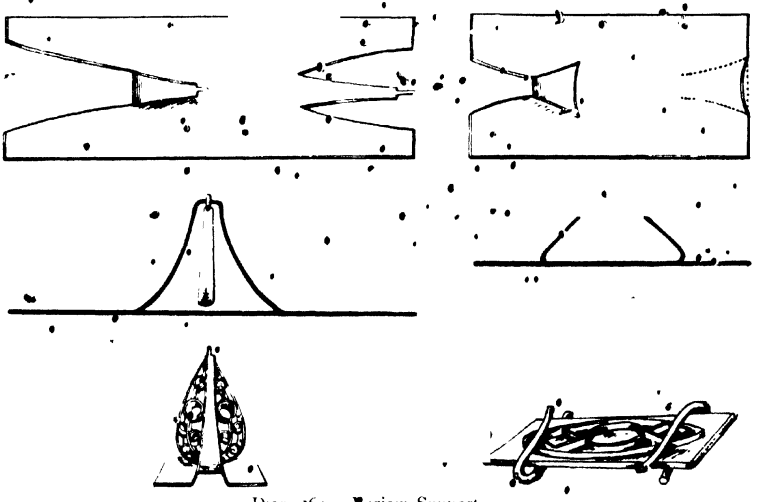
surface against the heat. Now paint the seams and points of contact with thin borax, and apply the minimum of 9-carat gold solder to each joint, using the mouth blow-pipe in the soldering.

Diag. 362

Diag. 363

The tiny grille resulting from this process may now be placed on a thin sheet of mica previous to the insertion of the enamel.

If the surface is small, it will remain perfectly flat; if large, however, small strands of sheet nickel may be utilised in binding it in position;



Diag. 364 Various Supports

or a thin plate of aluminium bronze may be used, and its edges slightly bent over the filigree as a greater security.

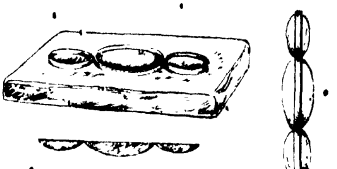
The above methods are always more reliable for the first firing of plique à jour enamel; while the upright position may be employed

for future firings (when possible) or in work demanding a special preparations. Diag. 364 will convey several positions of the work during the process of firing.

In filling the perforations with ground enamel, keep it slightly full towards the centre, which will circumvent shrinkage, and any fulness resulting will add to the liquidity of the colour.

Several firings, with careful application, will be necessary to complete the work.

The enamel sections may be produced in relief by fixing the filigree on a mould made of specially fine plaster-of-Paris, or dental casting powder (Diag. 365). The concave sections are then graved out where desired, and the mould slowly and perfectly baked to get rid of all moisture.



Diag 365

The ground enamel is then applied, to the required height, fired and refilled with enamel until the desired surface is attained.

Bowls, Cups, or Similar Vessels may be successfully treated in this style by engraving or carving the design on their surface, until the remaining metal of the interior is reduced to a "skin."

Into these cells the enamel is placed, fired, and refired until a uniform surface is acquired.

The "skin" of metal is now treated with nitric acid until thoroughly dissolved.

Other methods include the use of gold wires soldered to the copper bowl in the formation of the design, the copper shell being dissolved with acid after the completion of the enamelling.

Plique a jour enamel, while exacting in its preparation, is fascinating in results, and it affords a wide field for experimental work.

CHAPTER XXIX

BASSETAILLI AND ENCRUSTED ENAMEL

Bassetaille Enamel is specially suited for work in gold and silver—the precious metals magnifying its heights and intensifying the shadows.

Its practice gives full scope for masterly touches with the graver, cutting chisel, or repoussé punch.

It may be effectively applied to the decoration of small panels, finger-rings, pendants, and lockets.

Engraved or Chased Panels must be executed on fairly thick metal, not less than size 12 in gold or silver, and size 20 in copper. Repoussé panels may be wrought on much thinner metal; sizes 5 or 6 in the precious metals, and sizes 25 or 26 in copper, will be of sufficient strength.

Model the relief slightly lower than the surrounding rim, the resulting cavity acting as a bed for the various colours (Diag. 366) and leaving sufficient

Diag. 366

Diag. 367.

margin for a final surface of clear, transparent enamel. Foils of various tints and forms may be inserted. Dry off each colour with the blotting paper before applying another, which will prevent the enamels intermixing and muddiness appearing in the firing.

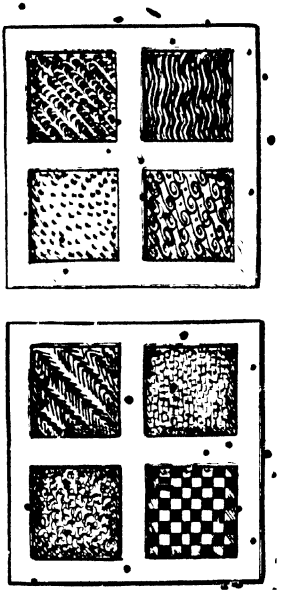
In chasing or carving the reliefs, aim mainly at a direct and strong effect.

Shadows will show to best advantage if imparted with thin but deeply incised lines (Diag. 367).

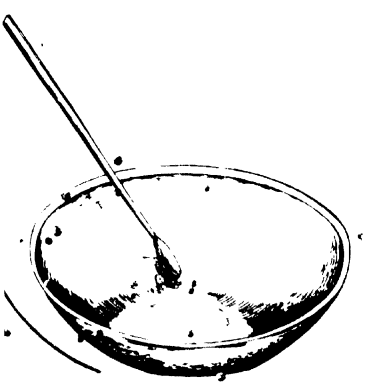
Wave Effects may be attained by a sculptured treatment of the ground (Diag. 368), while *stitched* or *dotted lines* will produce results of varying effect when coated with a surface of translucent enamel.

Encrusted or Coated Enamel is the direct fusing of the medium over a metallic surface; not necessarily with engraved walls as in champlevé, or outlined with wire as in cloisonné.

Complete chasings in bold relief on panels, bowls, or cups, may have their entire surfaces treated with various colours.



Diag. 368



Diag. 369

Small figures entirely on the round may be coated by this process.

The surface of the metal, previous to the application of the enamel, must be slightly "flinked" with a graver or small cutting chisel.

Tea-caddies, small bowls, and spoons may be coated in a similar manner.

Apply the enamel in a thin, uniform layer (Diag. 369).

A surface of flux on copper will result in many varying shades of gold.

CHAPTER XXX

LIMOGES OR PAINTED ENAMEL

Painted Enamels derive their outlines from the colour scheme only, without wire, cells, or chased details.

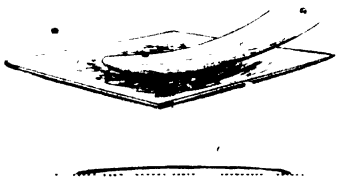
Faithfully conceived, each production should be a decorative creation, "born of the fire." Executed on traditional or experimental lines it has few limitations to the ingenious worker.

After study of the preceding chapters, the student will have attained a passable knowledge of the application of the various tools and material associated with the craft.

Consequently, the practice of Limoges enamel may be attempted with considerable confidence, irrespective of its acknowledged difficulties.

The outstanding features are its brilliant and mystical colour schemes, unfettered by walls of metal or ribs of wire (mainly associated with the execution of champlevé, or plique a jour enamels).

The Metal (preparation).—If in gold or silver, use sizes 4, 5, or 6, metal gauge, and sizes 25, 26, and 27 in the baser metal, keeping the relative weight in proportion to the dimensions of the work. After cutting the metal to size with the shears, and regulating its edges with a smooth file proceed to strengthen and key its outline for the reception of the enamel.



Diag. 370.

This is best accomplished by doming the panel towards the centre, and slightly rounding the edge (Diag. 370).

The Steel Burnisher may be used in this work, but only for small panels or thin metal. Larger panels must be wrought over a steel stake or edge of hard wood with a wood or horn mallet, and latterly planished smobth with a steel hammer. During the process keep the metal soft by frequent annealing (Diags. 355 and 356).

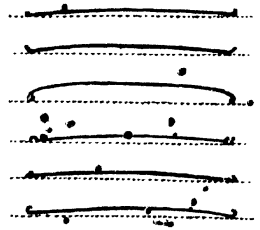
After working the edge to shape, file it level at the base, leaving the resulting ir[illegible] or "burr" of metal to act as a key to the enamel.

Many variations of these edges are possible (Diag. 371), and their use adds considerably to the strength of the panel, and affords an excellent grip to the delicate medium.

If the enamel panel is intended for setting purposes, first complete the firing before preparing its cavity, otherwise the alteration of its original size, as a result of the firing, might lead to future difficulties.

Panels, if embedded in plaster-of-Paris with a little alum, and thoroughly dried, will maintain a more uniform surface (Diag. 372).

The Enamel may now be ground and thoroughly filtered, until the milky hue has disappeared, and the clear, glistening medium remains.



Diag. 371.

Diag. 372.

Opaque enamels will not require excessive washings.

Before grinding the enamels, work out the colour scheme on paper; afterwards, if in doubt regarding the enamel, fire a small test-piece. Apply the colours from the point of a small palette knife, and flood the moistened enamel over the metal with a small brush. A first firing of flux may be used as a base, which on copper, with a quick firing, will result in a rich golden yellow; on silver, a satin finish with a tinge of yellow; while gold will reflect its original hue.

The obverse side of the metal will require counter-enamelling, using for this purpose any of the "backings" obtained from the surplus grindings. A little gum tragacanth may be added to the enamel during its application.

Objects of an irregular shape may have the ground enamel "caught" on their surface with the addition of a little reduced collodion; this ingredient leaves the minimum of residue, which is a most necessary quality for the purity of the colour, and reliability of the enamel.

Bells of air, small "blank" surfaces, or other blemishes occurring on the base of flux must be carefully cleaned with the acid, picked out with the graver, and finally washed with hydrofluoric acid and water.

The defects must then be carefully filled with ground enamel and refired.

After the attainment of a satisfactory surface the other colours may be gradually applied in thin uniform layers; carefully dry out one colour before adding the next; this method will prevent the one medium flowing through the other and causing an irregular and muddy effect. Care must be exercised to fire the harder enamel first, and gradually add the softer mediums.

Enamels generally do not mix well, better results being obtained by fusing one colour over the other.

Diag. 373

Painted enamels demand a finer application of the medium, therefore, in the final grinding, use the agate mortar or ground glass slab and mullar, moistening the enamel with a little oil of lavender or glycerine and water (Diag. 336).

Foils may be inserted as in champlevé or cloisonné—gold foil under greens and yellows, some blues and reds, silver under blue and violet. Dome the foils slightly, for a crinkled effect on certain work will produce a unique effect.

Pierce the surface of the foils with needles to allow escape of air (as previously directed) and soften any hard outlines by a careful shading of the enamel. If the foil becomes tarnished, remedy this defect by carefully annealing in the enamel kiln.

Grisaille (Diag. 373).—This strong, decorative style of the old Limousins with its dense black, or deep blue grounds, shaded and ornamented by the application of thin, delicate layers of finely ground white enamel, has much to interest and evoke the emulation of the student.

The Process.—Upon a ground of black or deep blue the white powder may be effectively applied by stippling, using in this process a needle or fine spatula.

Repeated firings will be necessary to realise perfect effects of light and shade.

Oil of lavender, or glycerine and water may be used in grinding the

enamel. Rich details can be suggested with foil; drapery, hair, and similar parts may be outlined with gold (solid or in dots).

In firing special care must be exercised, otherwise the thin and delicate layers of white are liable to become absorbed (if over-fired) in the background. Thoroughly dry off all the medium employed in the grinding of the enamel before inserting the work in the kiln.

Foils require an extremely light firing. Iridium may be employed for painting fine shading lines in black over their surface. This medium can be obtained prepared, and may be applied direct to a metal or enamel surface. Use a little gum tragacanth or fat oil of turpentine in its application.

Transparent and opaque enamel combined may be introduced in a lustred effect. Grind the transparent medium to rough, faceted chips; afterwards blend it with the opaque colour, keeping it slightly in excess.

Fire the enamel very carefully to avoid entirely fusing the transparent colour. After firing, grind its surface to a perfect level, and finish it with a high polish, when the beauty of the two mediums will be fully realised.

Backgrounds of white may also be prepared, and various schemes of decoration applied to their surface in a style similar to the highly coloured Battersea enamels of a century ago.

Treated decoratively good results are possible, but the general effects are too suggestive of miniature and china painting.

Practical Notes on the Process

Enamel may effectively be removed from a metallic surface by applying light vibrations on its obverse side with a steel hammer while held in cold water, which will result in the medium cracking. Now apply to its surface a paste of hydrofluoric acid and fluorspar, and allow it sufficient time to act before washing off.

Thin layers may be dispersed by a slight application of heat and a sudden quenching; any small "specks" remaining may be ground with corundum or "flinked" with a scorper.

Density of colour (in parts) may also be remedied by grinding with the corundum file and refiring.

If a panel becomes twisted during the firing, replace it in a kiln until the enamel is fused. Immediately remove and place it upon a hot level surface, simultaneously bringing a heavy pressure to bear upon the objectionable parts.

The hot edge of a large palette knife will be serviceable in this work (Diag. 374).

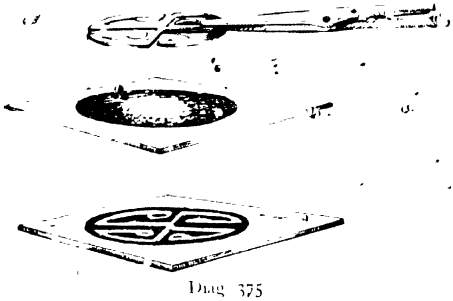
Small sunken spots on any part of an enamel after firing may be attributed to various reasons.

They are principally the results of air expulsion caused by oxidisation, hurried drying, or too coarse an application of the first colour layer. Unobserved flaws or blisters on the metal surface, resulting from the rolling, may also be the cause.

Diag. 374

Enamels or jewels will not stand an excessive heat (in repairing) without discoloration or other injury. Therefore, in the event of an accident and in repairing with solder, wind strips of damp asbestos over the enamelled parts as a protective.

Jewels, transparent and opaque, may be executed in enamel with fair success and peculiar effect. In their production raise a similar form in thin metal to the jewel required; afterwards fire a layer of flux over its surface, then wrap it in gold or silver foil, turning the edges of the foil slightly under to secure its position. Translucent colours in various tints may now be fused over its face with effective results.

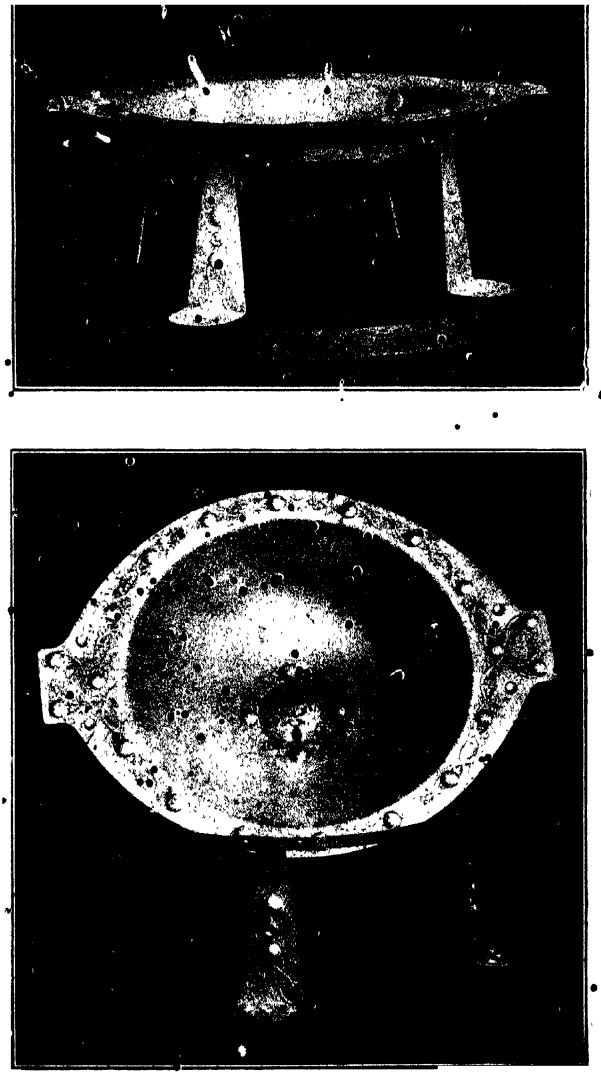


Diag. 375

Foils with a crinkled skin will prove even more telling when combined with careful shading of the enamel.

Greator strength and similarity to a jewel may be obtained if the enamel is fired into a box setting; or small "galerie" settings may be filled with enamel and fired as in plique a jour. Unique results may also be obtained by firing a surface of enamel, and while in a molten condition pressing into its surface a previously fretted decoration (Diag. 375).

Gum Tragacanth may be purchased in powdered form and prepared for use by reducing it in a little hot water to liquid form. A few drops of quince juice added will improve its condition.



Diag 376.—The Craik Bowl.

Quaich in Solid Silver, presented to Sir Henry Craik, K.C.B., LL.D., by the London Staff at
Designed by Miss Dor, Carleton Smyth. Enamel by Miss De Courcy Lewthwaite Dew
Carving by Colin Kenmure. Silversmithing and Repoussé by P. W. and W. A. Davids
of the Glasgow School of Art.

CHAPTER XXXI

REPAIRING, FINISHING, AND POLISHING OF THE METAL SURFACE

Commercial work generally betrays an objectionable weakness of over-finishing, to the detriment of the natural tooled effect resulting from its production.

Likewise, in a similar degree, the tendency to under-finish is prevalent in much of our modern craftwork under the mistaken conception that it adds to the artistic value of the object. Therefore, it will be important for the student to fully realise what repairing and finishing implies.

The process implies the complete removal of surplus solder or blemishes arising from the use of the file, scraper, chisel, dividers, etc., by the application of pumice (lump and powder), water-of-Ayr stone, crocus, buff, and burnisher.

In their use care must be exercised to preserve all the original quality of the hand-wrought surface.

The Necessary Tools and Material

The File in various grades.

Scrapers of various shapes and sizes will be required after the application of the file, which will produce a smooth and clean surface of metal.

To level a surface of metal apply the flat scraper slightly moistened and at varying angles.

The Shave Hook (Diag. 70) (round and flat) is a special type of scraper mainly required in soft-soldered work.

The Brass Scratch Brush is principally employed for cleaning and bringing up the colour of the metal. It will prove more effective if used with soap and water, and with a revolving action.

Repoussé ornamentation may be considerably intensified by its application.

Lump Pumice Stone (smooth) **and Water** may be applied after the scraper in smoothing the metal surface.

The water-of-Ayr stone will follow the use of the pumice. It may be obtained in grades, rough or smooth, and is unequalled for the production of a smooth skin on metal. In the form of small tapering pencils it is indispensable for the finishing of fine detail.

The Steel Burnisher (Diag. 66) will be found most adaptable in removing small scratches or other blemishes from undercut parts of the work.

Polishing Powders, including crocus cake, tripoli, and rouge may be used with the leather, felt, and calico buffs.

Chamois leather, cut in strips and applied with rouge in the form of a paste, will readily reach irregular shapes or intricate detail.

The Lathe or Polishing Head will be required to carry the various buffs, calico mops, and dollies. Failing the services of a wheel, polishing sticks may be used, covering their surface with fine emery, chamois leather, basil, or felt, with the addition of a suitable powder applied in paste form to their surface. Rouge and water, crocus and oil, or alcohol and silver whiting will each provide a reliable paste for the precious metals.

Brass, copper, zinc, etc., may be cleaned with a paste composed of rotten stone or Spanish whiting, combined with a little fine salt, oil of turpentine, and methylated spirits; apply it with a circular action.

Shellac and **spirits of wine** mixed, afterwards strained and clarified, may be applied as a lacquer in preventing the tarnish of brass and copper.

Silver plate, after polishing and previous to stoning, may have its surface preserved with a slight application of olive oil. Previous to use, wash off in hot soapy water.

After smoothing the metal surface, a certain texture or colouring will be required to emphasise and enhance the latent qualities of the various metals.

Great restraint is required in this process, as the natural tone of a metal seldom disappoints, whereas the risk of creating a highly polished and false effect is ever prevalent.

In the finishing of gold, silver, or platinum, the natural tone acquired in the tooling is always pleasing; unique effects are possible with an old gold or tobacco leaf tint, or the unapproachable silver grey of the whiter metal.

Jewellery or similar work with fine detail must have all discolourings arising from the use of solder effaced before attempting the final finish.

This process will be better accomplished by submitting the object to a "stroke" of gold or silver, afterwards oxidising and surface tinting until the required degree of light and shade is attained.

The fumes of ammonium sulphide (if strong) may be utilised for the above process. Larger work may be immersed entire, or the chemical applied with a soft brush, with the metal slightly warm.

After rinsing the work in water, dry off with a soft cloth, and work a fine brass scratch brush in circles over its surface, which will restore a uniform tone.

The Wheel or Hand Buff may be applied in parts to restore the original colour and intensify the effect.

Silver (bright), if placed immediately above a tray of burning sulphur to receive the fumes, will assume beautiful shades of blue, brown, and grey. If too dark, the silver grey may be increased by an application of the hand-buff combined with a little rouge.

Copper (bright) will acquire varying rainbow shades if subjected to waves of heat from the blow-pipe or a gas-jet.

In this process the colour must be carefully watched, and the work withdrawn on the attainment of the desired shade.

It may be fixed for a considerable time if a thin film of yellow bees-wax be diffused and lightly wiped over its surface. Similar results may be obtained by suspending the work immediately above the fumes of ammonium sulphide. The atmosphere also exerts an important action in the tinting of a metal, copper being the most receptive.

Opaque finishes on metal may be obtained with sand blasting, or by the more desirable method of a light, circular scouring with powdered pumice, bathbrick, or fine sand.

Brass may be brought to a fine yellow colour by annealing, and boiling off in hot sulphuric pickle; or to a glistening shade by a momentary immersion in a bath of nitric acid and water.

Pierced Decoration or Fine Detail in brass may be brought to a fine colour with the juice of a lemon combined with Spanish whiting.

Brass, after polishing, will acquire a fine shade of brown if imbedded in damp moulding sand. On removal, a polish in circles with a soft dry duster will render its condition almost permanent.

A green bronze shade may be applied to brass in a simple manner by "pouncing" damp blacklead over its surface with a brush; when dry a final brush off and polish will produce the desired result.

Zinc, Aluminium, German Silver and similar alloys may be effectively cleaned with finely powdered salt moistened with lemon juice.

In the application, permit it to act for a few minutes before removing, polishing latterly with tripoli or whiting combined with a little paraffin to form a paste. Avoid the use of soda with aluminium, owing to its tendency to dull that metal.

In polishing work with delicate chasing, engraving, etc., cover the surface with a protective composed of fine whiting and glue. These ingredients when hard will set like "gesso," but can be readily removed with boiling water.

Oxidising of Silver—

Sal-ammoniac	2 parts.
Sulphate of copper	2 ,,
Saltpetre	1 ,,

Grind the above ingredients to a fine powder, and dissolve in acetic acid, afterwards bringing to boiling point, and immersing the object, or applying the solution with a soft brush.

Zapon and lacquered surfaces (generally) are better avoided in the finishing of craftwork.

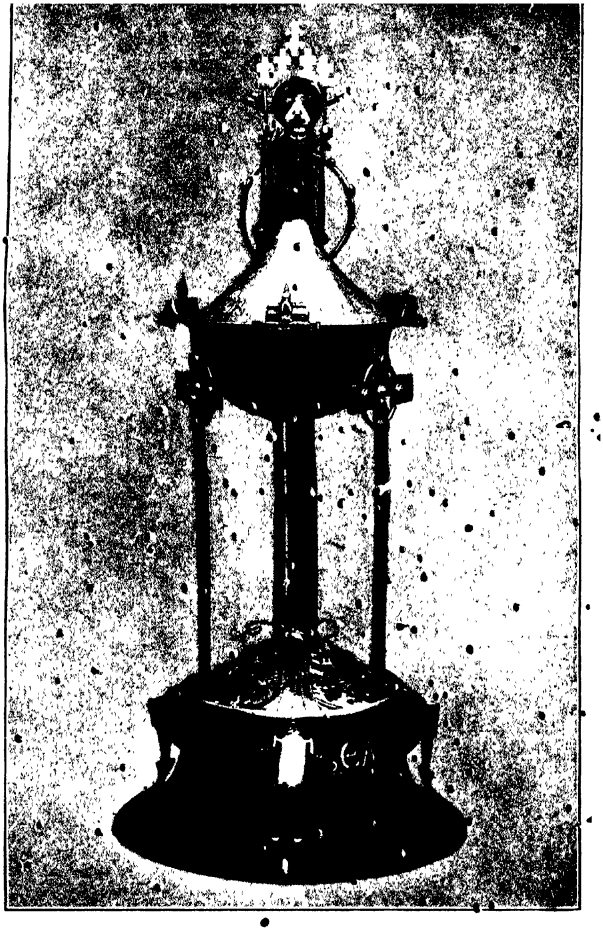


Plate 377.—The Cup of St. Mungo

Designed and Executed by the Author

CHAPTER XXXII

SCHEME OF WORK FOR REPOUSSÉ AND SILVERSMITHING

1. REPOUSSÉ in Metal.—The Tools.—Simple exercises with the outliners in the production of pattern and design.

2. Exercises with the dotting punch from the front and obverse sides of the work.

3. The application of the outliners and dotting punch (combined).

4. Embossing of simple forms with the rounded modellers or hollow punches.

5. The making of repousse punches from steel wire and forged "blanks."

6. Preparation of the pitch (hard and soft).

7. Annealing and chemical cleaning of the metal.

8. Simple sheet metal working—setting out various forms on thick paper.

9. Flat sheet metal work embracing boxes, sconces, mirrors, photo frames, etc.

10. The "raising" of metal from the flat sheet to the round.

11. Decoration of globular forms, introducing the use of the snarling iron.

12. Melting of metal; casting wire ingots and forging previous to the use of the draw-plate.

13. Drawing of tubes, chenier, and solid wire, also the process of "mock" wiring.

14. Their application to boxes, cups, bowls, etc., also the making of joints and hinges.

15. Soldering, hard and soft, with the large foot blow-pipe, soldering bit, and small mouth blow-pipe.

16. Sand moulding and casting.

17. Cleansing, repairing, and retouching of castings.

18. Spoon-making.

19. Finishing and polishing.

20. Surface colouring.

SCHEME OF WORK FOR JEWELLERY

1. Wires.—How to forge and draw them to various thicknesses and shapes by the application of draw-plates.

2. Their use decoratively—the production of design by different arrangements of units in drawn wire.

3. The production of links of varied shape from wire, and by the aid of mandrils.

4. Chain-making (as the result of previous process).

5. Making grains by the fusing of cuttings.

6. Forging of wire into various forms, and their application.

7. Simple and compound twists, using round, square, oval, and triangular wires.

8. Hard soldering with mouth blow-pipe, using gas or spirit lamp.

9. Combining pierced and chased details with various forms of wire, in designs, with the use of solder.

10. The making of settings for stones and enamel panels.

11. The crucible, and melting of the metal.

12. Simple pattern-making, moulding, and casting.

13. Simple ring of silver set with stone.

14. Brooch of silver set with stone or enamel.

15. The insertion of the brooch pin.

16. The piercing-saw, how to use and apply it.

17. Preparation of a piece of jewellery (without solder) intended for enamelling.

18. The making of a simple buckle.

19. A set of buttons in twisted wires.

20. The graver and how to apply it.

21. The chaser's hammer and punch, their application in finer work on the precious metal.

SCHEME OF WORK FOR ENAMELLING

1. The preliminary preparation of the metal—cutting, doming, and cleaning.

2. The enamel—grinding and washing previous to its application on the metal surface.

3. The "flooding" of the moist enamel over a metallic surface—study of enamels combined with the use of gum tragacanth.

4. The enamel kiln—its characteristics—use of the cradles—insertion and firing of the enamel.

5. Cooling and cleaning of the enamel after firing.

6. Application of gold and silver foil.

7. The use of the cutting chisel and graver in preparing simple designs in Champlevé enamel.

8. Application of the enamel in Champleve—a limited colour scheme.

9. Surface finishing with corundum, pumice, and water-of-Ayr stone.

10. Coated enamel—its application to hollow-ware.

11. The preparation of a casting by planishing and flinking, previous to the "charging" of the enamel.

12. Cloisonné enamel—simple forms of cloisons.

13. Securing the cloisons in position.

14. Filling in the wire cavities with enamel.

15. Drying and firing, recharging, levelling, and final polishing.

16. Plique à jour enamel—its special preparation.

17. Bassetaille enamel. The excavation of a bas-relief with chis.. and graver.

18. Application of the enamel in Bassetaille.

19. Introduction to Limoges enamels.—Simple exercises with restricted ...our schemes.

20. Experimental work, embracing original and exclusive treatments.

CHAPTER XXXIII

MATERIALS, AND WHERE TO GET THEM

Bull's Metal may be obtained from Bull's Metal and Melloid Company, Limited, Yoker, near Glasgow.

Chemicals. Messrs. Baird & Tatlock, Laboratory Furnishers, Chemical Dealers, 45, Renfrew Street, Glasgow.

Material, Enamels, etc.—Messrs. Calipe, Dettmer & Co., 21, Poland Street, Oxford Street, London.

Requisites of the Craft.—P. Wylie Davidson, 5, Ruskin Square, Bishopbriggs, Glasgow.

Duralumin (Sheet and Wire).—Vickers, Limited, Vickers House, Broadway, Westminster, London, S.W.

Enamel Kilns and Blow-pipes.—Messrs. Fletcher, Russell & Co., Limited, Palatine Works, Wilderspool Causeway, Warrington.

Jeweller's Requirements.—Messrs. E. Gray & Son, 18, Clerkenwell Road, London, E.C.

Metals.—Messrs. Chas. Harrold & Co., Limited, Assayers, Refiners, and Dealers in the Precious Metals, 2 & 3, St. Paul's Square, Birmingham.

Fret Saws, etc.—Messrs. Hobbies, Limited, Dereham, Norfolk.

Metals, Copper, Brass, etc.—The "Mint," Birmingham.

Jewellery and Silversmithing Tools, Enamels.—Messrs. C. J. Pluckbett & Co., Limited, 29, 30 & 38, Poland Street, Oxford Street, London, W.

Precious Stone Dealer. Arthur S. Wainwright, 185, Warstone Lane, Birmingham.

CHAPTER XXXIV

THE EQUIPMENT OF A SMALL STUDIO

Square Island Bench (if the light is good) 2½ to 3 inches thick.

A semicircle may be cut out of one side to accommodate the bench-pin and skin. On the above bench silversmithing, jewellery, and repoussé may be executed.

A Clean, Solid, Low-set Table suitable for enamelling.

Sheet Iron, 2 feet square and mounted on suitable legs, will provide a good pitch bench.

Revolving Soldering Table 12 to 15 inches in diameter, and covered with broken charcoal, coke, or pieces of fireclay.

Gas Blow-pipe (with tips about 10 inches long) with **Foot Blower** in proportion (Fletcher, Russell & Co., Limited).

12-inch Brass Foot Rule and Steel Square.

Bench Anvil or Flat Iron (adapted). It may be kept stationary by insertion in the silversmithing bench. **Round Triblet** (gins).

Strong Leg Vice or Horizontal Bench Vice. An additional **Small Vice** for jewellery would be required.

Small Bench Soldering Burner for Blow-pipe Work.

Charcoal Block (concentrated).

Two Mouth Blow-pipes (large and small).

Iron Binding Wire (two sizes: thick and thin). **Wire Soldering Wig, Moulding Flask, and Small Sand Box.**

Borax Dish or Slate with Borax Stick.

Lead Block, Wooden Doming Block, also a **Tree Block** with various circular hollows cut on its surface.

A Spirit Soldering Lamp may be utilised *if gas is not available.*

Tweezers for placing the solder, **Jeweller's Soldering Bit.**

Boiling-out Pan (from sheet copper not less than size 12).

Sulphuric Acid
Nitric Acid
Hydrochloric Acid
Fluoric Acid

Several Earthenware Jars for retaining the various pickles.

Several Large Files (mainly half-round, rough, and smooth).

Small Skew Nippers, Small Straight-Nosed Cutting Pliers, Small Round-Nosed Pliers. Small Hand Vice.

Large Straight-Nosed Pliers. (They may also be used as draw tongs.)

Draw-plate (medium size), Filigree Draw-plate.

Large Straight Shears, Small Clear Straight Shears, Small Clear Bent Shears.

Steel Dividers (spring, medium size).

Several Scrapers, Calipers (medium size).

Several Brushes for Borax, etc., Sparrow Hawk.

Cow's Tongue Stake (for raising), Snarling Iron (double end, large and small).

Sand Pad, Beck Iron.

Various Lengths of Wire—tubular and solid.

Small Tongs, Soldering Bit (for soft solder work).

Drillstock and Drills, Shave-hook, Joint Tool.

Several Gravers, Cutting Chisels, and Scorpers.

Steel Draw-point, Furnace Tongs.

Saw Frame and Blades.

Chaser's Bullet (half) filled with hard pitch for small work.

Wooden Triangle, or Leather Collar, to bed the pitch bowl.

Pitch Box for Repoussé (not less than 12 inches square), filled with soft pitch.

Chaser's Hammer, Six Repoussé Tools.

Several Wooden Punches, Twenty to Thirty Chasing Punches.

Flat Wooden Mallet, Wooden Doming Mallet.

Horn Tip, Silversmithing Hammer, Small Planishing Hammer.

Large Ladle or Three-Legged Pot for melting pitch; the ladle could also be utilised for melting lead, etc., if thoroughly cleaned.

Oilstone and Oilcan.

Muffle Furnace for Enamelling (of medium size).

Pestle and Mortar, Grinding Slab and Muller.

Corundum File, Brass Scratch Brush.

Several Rifles and Needle Files.

Water-of-Ayr stone and Pumice (lump and powdered).

Three-Cornered Scraper, One Water Globe (indispensable for small work).

Several Hand Buffs, Steel Burnisher.

The Base Metals may be bought by the sheet, 4 feet × 2 feet, or in continuous rolls 1 foot broad.

Wire may be bought by the pound and reduced in the **Draw-plate** as required.

The Precious Metals may be purchased by the ounce, also **the Solders.**

Cloisonné Wire is sold by the yard, and **Gold and Silver Foil** by the sheet.

The Enamel (raw material) may be obtained by the ounce.

Nickel and Silica Cradles.

Gum Tragacanth.

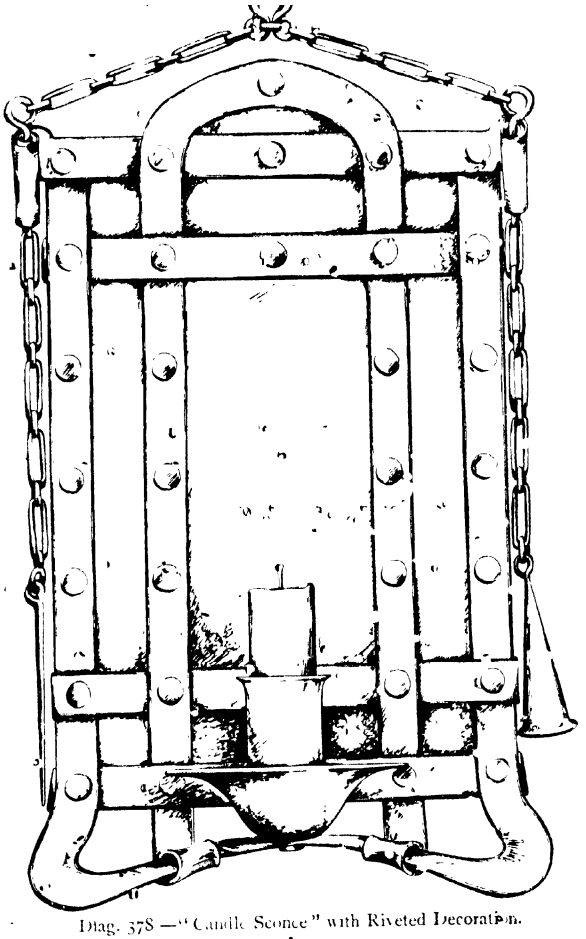
Oil of Lavender.

Two Palette Knives (large and small).

Blotting-paper (white).

Shell Gold and Silver.

Polishing Powders, emery, tripoli, and rouge.



Diag. 378 — "Candle Sconce" with Riveted Decoration.

GLOSSARIAL INDEX AND REFERENCE NOTES

A

Acids, Sulphuric, Nitric, Hydrochloric, Muriatic and Hydrofluoric are those principally used in Metalcraft, 29, 164, 167, 172, 180, 181, 194.

Acid Baths, vats, generally of stoneware or sheet lead, used for retaining the various pickles, solutions, etc., 29.

Alabaster Cement, alum combined with a small quantity of white of egg; use whilst warm, 139, 141.

Alcohol, applicable in cleaning metal with silver whiting; helpful in dissolving Gum Tragacanth and in mixing powders to a paste, 29, 139, 198.

Ale (sour), useful in conjunction with soap-suds as a metal cleanser; improves the condition of moulding sand, 149.

Alloy, the baser metal which is impregnated with a finer, to produce varying strength, fusibility, reflective power, and colour, 9, 28, 45, 161, 170.

Alum may be inserted to provide a hardening effect on plaster-of-Paris moulds, thereby rendering them more capable of withstanding the fire, 148, 168, 187, 193.

Aluminium, a suitable metal for decorative treatment. It may be obtained in sheet or wire. In constructional work, use the rivet in preference to solder, 9, 10, 28, 156, 199.

Aluminium Bronze, a strong resistive alloy useful as a base for Plique à Jour enamel, 188.

Aluminium Silver is composed of 60 parts copper, 20 parts nickel, and 5 parts aluminium. This alloy when polished will acquire a lustrous, silvery finish.

Amalgam, a combination of gold and mercury used in gilding and inlaying, 153.

Ammonia, useful in the colouring and cleaning of metal, 173.

Ammonia Chloride, applicable in the tinting of metals, 200.

Ammonium Sulphide, suitable for colouring the various metals to different shades; if applied warm it will prove more effective, 181, 199.

Annealing, the process employed to restore ductility to certain metals by the application of heat until they attain a cherry red hue, 12, 27, 28, 29, 79, 89, 172, 183, 192.

Antimony, a white, brittle metal of bluish tinge, useful as an alloy, 47, 143, 157.

Anvil (bench), a flat steel of varying weight with a square and a rounded edge for planishing sheet metal to a uniform surface. (An ordinary flat iron proves a good substitute), 17, 70, 92.

Armenian Cement, a special cement used in certain setting, 139.

Asbestos Blocks, employed for soldering purposes. In threads the asbestos may be used when damp for the protection from heat of stones or other parts during the execution of a repair, 28, 52, 196.

Assay Cupels, the cups employed during the process of metal refining.

Assaying, the process which determines the correct quantity and quality of the precious metals.

B

Backing, the support added on the obverse side of Pewter Modelling or work of a like nature, 27.

Backing or Soling, the process of mounting, or backing, a hollow piece of jewellery with a flat

support of plate on the obverse side. The term "backing" is also applied to the enamelling of the undersides of panels, plaques, etc., with surplus ground enamel, 176, 193.

Back-stick or Centre pin, a guiding tool used in the process of spinning metal, 87, 88.

Ball or Half-ball, large hollow beads in metal, 25

Ball-faced Hammer, has a well-rounded face; useful in drawing up hollow shapes or bosses on thick metal, 25

Band, Bezel, or Collar of Metal, employed in settings, or when fitting a lid in a tankard, cup, or similar vessel, 132.

Bas-relief, a surface modelled in low relief, 96, 185.

Bassetaille Enamel, implies a deeply incised or tooled treatment of the metal, with transparent enamel flooded in until a level surface is obtained. This method intensifies the underlying shadows, 164, 166, 190.

Bath (acid), receptacle for the insertion of metal or enamel when under the action of an acid, 173.

Bathbrick, a compressed sandy substance, used for scouring purposes, 30, 48, 132, 142, 144, 150, 157.

Battersea Enamel, a dainty application of painted enamelling, somewhat deficient in decorative treatment, and more akin to china painting. It was much in vogue during the early eighteenth century, 195.

Beading Tool, a steel punch with a uniform repeat of small, incised balls or beads which, applied with a revolving pressure on softer metal, produces a rich effect. A single bead is employed in the execution of a threaded and grained setting, 138.

Beads, circular blobs or grains of metal, formed by fusing small cuttings or rings in prepared circular cavities on the charcoal block, 47, 112, 113, 119, 130, 138, 161.

Bearer, of hinge or stone, the shoulder of metal carrying the knuckle or joint; the rim of wire or plate which "beds" a stone or enamel, 133, 137, 138.

Beck Iron, a T-shaped stake with a tapering arm and oblong, flat iron, 58, 71, 132, 183.

Beeswax (white), provides a perfect medium for the transference of fine detail in pencil to silver or gold, by applying a thin film to the metal before transferring, 23.

Beeswax (yellow), required in the preparation of modelling, casting, and chaser's wax; an effective lubricant for saw-blades, 39, 141, 142, 143, 147, 199.

Bellows (foot or hand), the medium for supplying the air-blast to the blow-pipe or forge, 15.

Bench or board, the flat surface of the jewellery and silversmithing benches, including the pin, skin, sawboard, and revolving burner, 26, 167, 183.

Bench Pin, a wooden projection on the jeweller's board on which various processes of the craft are executed, 207.

Benzine, a useful cleanser of grease, etc., for small objects in metal, 30

Bezel, a circular tube or collet of metal, 137.

Bismuth, mineral useful as an alloy in casting owing to its softening properties; similarly in the preparation of pewter solder, 45.

Bit (copper), bolt or soldering iron, the medium for soldering with alloys of lead tin, or bismuth, 45–48.

Blanks, bodies of punches; incomplete details of rings, etc., 31.

Blind Tooling, the incision of a flat decoration by the agency of fancy or patterned punches in a manner similar to that employed in bookbinding decoration, 101, 102, 185.

Blisters, bells of air on a metallic surface after rolling, 196.

Blobs, the condition of small metal cuttings after fusing, 48.

Blotting Paper (white), utilised for absorbing the water from the moist enamel, which has been applied to the cells, 179, 190.

Blow-lamps, the principal one for the hard-soldering of light work is the Ætna; for brazing, the Barthel, 54.

Blow-pipe (large), with foot-bellows for heavier work in silversmithing, etc., 15, 19, 28, 48, 70, 167, 199.

Blow-pipe (mouth), small and adaptable for soldering light work, 28, 29, 47, 132, 188.

D

is suitable as a support, or cradle, in the firing of enamels, 14, 168, 169, 173, 180.

Iron Binding Wire, of various sizes, applied in securing separate details during the process of soldering, 99, 132, 144.

Ivory, Bone, Wood, or Horn Punches, most suitable for repoussé or other work on sheet lead, as they prove more sympathetic and responsive on the softer metal, 27.

J

Jets, the "gates" or "pours" in casting, 144.

Jeweller's Jet, the short, revolving, horizontal, branch gas-bracket on the jeweller's bench used for blowpipe work, 53.

Joints and Seams, the most common are the butt, lap, counter-sunk, riveted, grooved, flanged, and scarf joints, 71, 75, 132, 170, 171, 185.

Joints (Ball), for brooch, a special form of brooch joint, made by beating up a U-shaped form in metal, reversing its position, dishing it through, and locking it with a rivet, 110.

Joints (Burnt), used in jointing lead work.

Joint Tool, a small hand tool similar to a vice, but combined with a surface plate, which ensures the perfect mitring and fitting of joint knuckles.

Jump Rings, small loops or rings which connect or link up separate parts of a chain, or similar detail, 113.

Justifier, a graver with an oval pointed face, specially suitable in trimming or justifying the edges of cells in Champlevé enamel, 155.

K

Keys, small "pecks," or an "iris," of metal which help to hold firm enamel or jewels, 155, 157, 158, 165, 169, 170, 178, 187, 193.

Kiln, the furnace in which enamels are fired, 45, 164, 167, 170, 180, 185, 186, 194.

Kink, a lurch, or pucker, on a flat sheet of metal, which should be removed by annealing and careful planishing, 183.

Knuckles, the separate tubes or chenier which constitute a joint, 121.

Knurling, or milling tools, small decorated wheels of steel, which incise various patterns on metal when applied on the lathe, 88.

L

Lacquer, a thin transparent surface colouring applied to metal to retard oxidisation, 136, 198, 200.

Ladle of Iron, used when melting lead or pitch, 47, 146.

Lamps (soldering), render good service for home work, or in the absence of gas, 158.

Lapidary's Wheel or disc, is necessary in the grinding and polishing of stones, 139.

Lard, a useful lubricant, or facing, for a mould to prevent separate parts from adhering during repeated castings.

Lathe, the turning lathe, a serviceable machine for turning, polishing, spinning, and drilling, 75, 87-89, 102, 142, 198.

Lead, a soft, heavy metal of strong resistive properties, capable of unique decorative treatment, 9, 10, 15, 23, 24, 27, 45, 47, 91, 92, 102, 104, 143, 156.

Lead (red), useful in closing small leaks in pipe joints.

Lead Block, a block of lead one inch thick will prove of great service to the metal worker, 7, 27, 38, 67, 73, 104.

Leaf Gold, gold between silk paper in book form.

Lemel, filings, cuttings, and dross from the precious metals, 50.

Lemon Juice, useful combined with pumice powder in cleaning brass work with intricate detail, 199.

M

Magnet, by the use of a large magnet, dross resulting from the use of the file, binding wire, etc., may be successfully removed.

Mallets, in wood or horn necessary in working flat sheet metal to the round, 16-18, 25, 44, 71, 75, 79, 132.

Mandrils, in wood and steel, of varied shapes and sizes, are necessary in general metal work, 66, 91, 92.

Ochre (yellow), useful as a colouring medium in the making of wax, etc., 163.

Oil of Lavender, useful in the process of Limoges enamelling as a lubricant in the grinding of the colour; it evaporates freely and leaves little residue, 176, 194.

Oil (Linseed) may be employed with clay (in the consistency of a thick paste) to prevent separate moulds adhering, 141, 158, 186.

Oil (Sperm), with a few drops of glycerine, is useful in the sharpening of gravers, 154.

Oil (fat) of Turpentine may be used in the grinding of enamel; dry it off thoroughly before firing, 176, 195, 198.

Oilstone, for general work a Washita stone may be used; a small Turkey stone should be used for gravers and fine chisels, 31, 154.

Opaque Enamel, non-transparent enamel, 169, 174, 175, 178, 193, 195.

Overlays of metal may be made by piercing a surface and inserting, or mounting, an additional decoration of another metal, 37, 169.

Oxides, the objectionable films which form on a metal surface after the application of heat. Such oxide, forming on copper after enamelling, may be scraped off with a sharp edge of brass or German silver, 29, 173, 174.

Oxidising, the diffusion of colour over a metal surface by the aid of chemicals, 159, 186, 196.

Pastil, a very small oblong pastel of solder, 132, 161.

Palette Knives are useful in removing work from the kiln, or in spreading large surfaces of the ground enamel, 175, 179 181, 184, 186, 193, 195.

Panels in metal intended for enamelling are made stronger if a tiny edge—about $\frac{1}{16}$ of an inch—is turned up all round, 137, 183, 185, 190, 193, 195.

Paper (tracing) and tracing cloth, necessary in transferring and retaining drawings, 24.

Partial Gilt, an object, in silver, or other metal, gilded in parts, 181.

Parting Sand, the common parting sands are pea-flour, brick-dust, bathbrick, and powdered charcoal, 150.

Paste (Rice), a strong paste prepared by grinding rice to a fine powder and boiling it with water until sufficiently thick; a few drops of vinegar may be added as a preservative, 183.

Pattern Plate, a sample plate of tool impressions, obtained by grouping tool marks only, 20, 101.

Pea Flour, useful for dusting the face of a sand mould: employed as a "parting sand," 150.

Pearl Ash (Carbonate of Potassium), a valuable cleanser.

Pencil (camel hair), useful for applying moistened borax to fine joints, 49.

Perloir, a steel punch of single half-bead form, useful in modelling balls on metal, or in cutting foil for insertion in enamel, 97, 185.

Pestle and Mortar, necessary in grinding enamel, etc., 157, 168, 175.

Pewter, a soft metal of pleasing grey colour, well suited for decorative purposes, and capable of a fine silvery polish, 9, 10, 28, 40, 47, 143, 158.

Pewter Modelling, a simple surface decoration in relief on extremely light and soft metal, usually pewter, which is finally mounted on wood, 40, 41, 42, 43.

Piece Moulds, moulds composed and built up of sectional forms, 144, 145.

Piercing Saw, a necessary tool for piercing and relieving fine details in metal, wood, or ivory; saws of varying grades may be inserted as required, 37, 67, 99, 101, 110.

Pickles, two of the chief pickles are sulphuric acid pickle and nitric acid pickle, 28, 29, 83, 132, 167, 172, 173, 180.

Pin, the main necessity of the silversmith's bench; it is indispensable for resting the work during a variety of processes, 207.

Pin Tongs, light tongs with a small chuck, which effectively hold small pins of wire in position, 121.

Pipeclay, serviceable in the execution of small castings, 150, 168.

Reamer, a three-cornered steel point used in opening and widening holes in metal. The sharpened end of a three-cornered file will serve the purpose, 35.

Register Pins, or Pegs, the projections on the "peg" half of a moulding box, which lock into the "eye" half and complete the frame, 144, 145.

Repoussé, the method of embossing flat sheet metal to a decorated and modelled surface; the effect is produced mainly by working from the obverse side, 1, 5–7, 11, 15, 20, 136, 167.

Repoussé Hammer, a hammer with a small head and long tapering shaft, 2.

Residue, the dross or deleterious matter cast off from the melting, grinding, or stoning of enamel, 173, 175, 176.

Resin, useful as a flux in the soldering or melting of lead, 13, 14, 46, 47, 48, 141, 146.

Revolving Action, in polishing, produces the best results; otherwise the metal surface is apt to appear coarse and scratched, 30.

Riffler, a fine, curved file, similar in shape to a modelling tool, necessary in the retouching of castings. By its use flesh textures may be applied on figures, 151, 152.

Rings can easily be formed by winding wire, of any thickness, round a circular mandril of the size desired. Avoid making less than six rings (to allow for loss in case of imperfection), 34.

Ring Sizes, a set of linked and numbered rings, used for fitting the fingers in the taking of sizes.

Ring Stick, a circular triblet of wood for testing the sizes of rings, 207.

Ring Tools, ball or perlon punches with a circular ring impression, 70.

Rivets, of various sizes and shapes, are used as a substitute for solder and may be employed decoratively, 67, 68, 71, 73, 77, 121, 136, 171.

Riveting, the process of "locking" the short, blunt nailhead, termed a rivet, by resting it on the riveting stake and stretching the obverse end by blows from the riveting hammer, 37, 67, 152, 181.

Riveting Hammer, with oblong and round faces, slightly full towards the centre, readily spreads the metal end and thus locks the rivet, 3, 6, 7, 70.

Riveting Punch, a flat, circular punch with keen edges which may be utilised for punching rivet holes, 67, 68.

Rods of square steel may be forged into gravers and chasing tools, 33.

Rolling Mill, the steel mill, or rollers, employed for reducing the ingots, or skelats, of sheet metal, 89, 119, 161.

Rolls of Metal 1 ft. broad may be readily obtained, 208.

Rope Stirrup for the triangle, a parallel length of stout rope, let through two holes in the bench 1 foot apart; the triangle and work are supported between the rope, and the feet rest on the end of it, thus retaining the work in position.

Rouge (Jeweller's), useful as a protective in fine soldering; a good polish for silver, 147, 170, 180, 186, 198.

Rubbings in blacklead are useful for preserving references of decoration in low-relief; heel ball may also be used for this purpose.

S

Sal Ammoniac, valuable as a flux in soft soldering, or in tinning a hollow vessel, 149, 200.

Salt, a useful cleanser; combined with cream of tartar and pearl-ash it supplies a valuable flux in brazing, 198.

Saltpetre, useful as a flux and clarifier in the melting of metal, 200.

Sampler, a prepared pattern plate, useful to beginners for suggesting the possibilities of tools and material in the creation of pattern and design, 5, 20, 101.

Sand, fine sand free from stones and grit is used for scouring the baser metals after annealing and pickling, 16, 30, 48, 173.

Sand-bag or Sand-pad, a firm bed of sand useful during the early stages of working metal to the round, or in doming large surfaces in repoussé, 15, 78, 82, 175.

Sand-blasting, the process of applying fine sand with a blast on to smooth metal to produce an opaque and frosted texture, 199.

Slag, the residue of the melting-pot, 144.

Snarling Irons, zigzag steel tools with short, pointed projections at each end; they are used for bossing up parts in relief on tapering hollow vessels, 35, 96.

Snibs, revolving tabs of metal, used for fixing sheet metal on a surface of wood (in place of pitch), 15.

Snippets of Solder, or panels, so called from their square cut, and flat, oblong shape; if in curls they are liable to burn, 132.

Soap Root, combined with sour ale, will produce a good scratching solution.

Soda, a strong, effective cleanser, 171.

Solder, a fusible alloy, either hard or soft; obtained by the addition of an inferior metal to the purer, 27, 35, 47, 48, 170, 183.

Soldering, the process of combining separate details in metal by the agency of a suitable alloy, 37, 45, 75, 88, 180.

Soldering Bit, bolt, and iron, are used in the process of soft soldering, 45.

Soldering Table or tray, a revolving metal disc strewn with charcoal or broken fireclay, which provides a bed for soldering; 52.

Sparrow Hawk, a small but useful stake with a tapering round arm and one flat arm. It is similar to the beck iron, and will fit a small vice.

Spatula, a finely-pointed, nickel-plated tool used in the application of enamel, or in the fixing of foil, 157, 158, 173, 179, 180, 186, 194.

Spelter, a granulated form of solder used in brazing brass, copper, and German silver; it is made from copper and zinc, 52.

Spindle, a tapering rod, or centre pin of steel; adaptable in the making of tools, 34.

Spinning, the production of various forms in light metal by the agency of the lathe, 87.

Spirits (killed), hydrochloric or muriatic acid, with the addition of zinc, 46, 49.

Spirits of Salt, hydrochloric or muriatic acid, is used in the preparation of killed spirits by the insertion of clean zinc cuttings, 46.

Squeezes in Wax may be taken to judge the relative heights when embossing, or in the sinking of a die, 96, 102, 178.

Stampings, productions in metal resulting from being "struck" in a die, 102.

Stitching, a method of fixing a design to metal by the aid of punch markings, 7, 24, 97, 103, 190.

Stones, required in finishing objects in metal; those usually used are lump pumice and water-of-Ayr stone, 33, 102, 104, 136, 158, 181, 186.

Stonings, the residue obtained from the bottom of the stoning-tub. In the precious metals this mud is collected and the metal recovered, 186.

Stoning Tub, used in the finishing of the precious metals to collect the residue.

Struck, the term used in reference to a piece of work which has been produced from a die, or by stamping, 102.

Stylus, a fine point of agate or bone, useful in transferring a design from carbon paper to the metal surface, 23.

Sulphur (Flowers of), an oxidising agent suitable for bright silver; its fumes produce shades varying from peacock blue to black, 156, 157, 199.

Sulphuric Acid, or oil of vitriol, much used in working with metal, 172.

Sulphuric Pickle, prepared by mixing one part of sulphuric acid with eight or nine parts of water—adding the acid to the water, 29, 83, 132, 173, 180.

Surface Plate, or slab of plate glass, may be used to test the level of metal objects, 36.

Swage Plates create the mouldings on a solid wire when it is drawn through them, 89, 90.

Sweep, all bench and floor sweep is collected, dried, riddled, burnt, and magnetised; then chemically treated and melted to recover the precious metals.

Swivels, employed in joining lathe belts.

T

Tallow, a necessary ingredient in the making of pitch; useful as a lubricant, 13, 14, 18, 27, 30, 33, 48, 91, 141, 155.

Tempering, the process of hardening steel by heating it to a cherry red and quenching in tallow or water, 33, 102, 164.

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